

BATHYAL JOEROPSIDIDAE (ISOPODA: ASELLOTA) FROM SOUTH-EASTERN AUSTRALIA, WITH DESCRIPTION OF TWO NEW GENERA

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Abstract

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Fifty-three species of *Joeropsis*, listed here, have been previously described in this, until now, the only genus of the family. Characters in the Joeropsididae are tabulated and discussed to ascertain which may be diagnostic at family and genus level. *Joeropsis bicarinata* sp. nov., *Rugojoeropsis rugosa* gen. nov., sp. nov., *Scaphojoeropsis multicarinata* gen. nov., sp. nov., and *S. kimblae* sp. nov. are described from the lower shelf and upper bathyal of south-eastern Australia. All are strongly sculptured dorsally.

Introduction

Members of the Joeropsididae Nordenstam have been found around all continents and in all oceans from the North Atlantic and Pacific boreal to the subantarctic. Depths range from the intertidal to the midcontinental slope, with most species occurring on the mid to uppermost shelf. Up until now, the family included a single genus. Between them, Menzies (1962) and Wolff (1962) listed 14 species of *Joeropsis* Kochler; subsequently, 39 species have been described (Table 1).

Hale (1937) reported *J. patagoniensis* Richardson from subantarctic Macquarie I. No further records of Joeropsididae from Australia have been made, although many undescribed species exist in museum collections. The four new species described herein were collected on the lower shelf and upper slope (100–600 m, primarily below 200 m) off south-eastern Australia from south of Sydney to the east and west coasts of Tasmania. The four species differ from all other joeropsidids in having a strongly sculptured dorsum. Of the 53 species previously recognised, only *J. waltervadi* Kensley has some dorsal sculpture in the form of two low, broad, rounded, parallel dorsal ridges on the anterior pereonites. One of the new species is placed in *Joeropsis*; one in a new genus, *Rugojoeropsis*, and two in a second new genus, *Scaphojoeropsis*.

Length of specimens was measured from the tip of the pseudorostrum (see definition below) along the dorsum to the apex of the pleotelson.

Analysis of characters

The new forms of Joeropsididae encountered in this study suggested the possibility that new genera could be differentiated from *Joeropsis*. A

comparative analysis of the distribution of characters in the known and new species was undertaken to ascertain what might constitute diagnostic characters at the family and genus levels (Table 2).

Most known species of *Joeropsis* have been incompletely described, which renders interspecific comparisons difficult. Exceptions are *J. mediterranea* Amar, and the redescription, by Bocquet and Lemercier (1958), of *J. brevicornis* Koehler. The description of *J. vibicaria* Barnard contains few useful details. For most species (more than 30), the following aspects are illustrated in the literature: dorsal habitus view, mandible(s), maxilla 1, maxilliped, male pleopod 1, male and female pleopod 2, pleopod 3 and uropod. Other characters are occasionally illustrated and/or described in the text. In many cases, illustrations are difficult to interpret in detail. In several instances text and illustrations do not match.

Where information could be found, the following characteristics were consistent in species of *Joeropsis* and the four new joeropsidid species: general configuration of antennae 1 and 2; presence of a pseudorostrum (see discussion below); no coxae visible in dorsal view; no free pleonites; all percopods similar, ambulatory; shape of mandibular molar; number of articles in mandibular and maxillipedal palps; general shape of maxillae 1 and 2 (except *Scaphojoeropsis kimblae* sp. nov., maxilla 2 is strongly reduced); general shape of male and female pleopods; general shape of uropods. These characters are considered here to be diagnostic of Joeropsididae.

Table 2 compares another 21 characters potentially useful in discriminating between joeropsidid genera. Where 30 (an arbitrary selection reflecting availability of information) or more of

Table 1. Species of *Joeropsis* with area of type locality.

| |
|--|
| <i>J. affinis</i> Kussakin, 1961 (Sea of Okhotsk, Kurile Is) |
| <i>J. antarctica</i> Menzies and Schultz, 1968 (South Shetland Is) |
| <i>J. antillensis</i> Müller, 1993 (Martinique) |
| <i>J. beuroisi</i> Kensley, 1975 (South Africa) |
| <i>J. bicarinata</i> sp. nov. (south-eastern Australia) |
| <i>J. bifasciata</i> Kensley, 1984a (Belize) |
| <i>J. bonrboni</i> Müller, 1990a (Réunion) |
| <i>J. brevicornis</i> Koehler, 1885 (North-east Atlantic) |
| <i>J. caboverdensis</i> Müller, 1988 (Cape Verde Is) |
| <i>J. ceylonensis</i> Müller, 1991a (Sri Lanka) |
| <i>J. concava</i> Schultz, 1966 (Santa Cruz Canyon) |
| <i>J. coralicola</i> Schultz and McCloskey, 1967 (North Carolina) |
| <i>J. curvicornis</i> (Nicolet, 1849) (Chile) |
| <i>J. dollfusi</i> Norman, 1899 (Mediterranean) |
| <i>J. dnbia</i> Menzies, 1951 (California) |
| <i>J. fanrei</i> Müller, 1990a (Réunion) |
| <i>J. gertrudae</i> Müller, 1989a (Society Is) |
| <i>J. hawaiiensis</i> Miller, 1941 (Hawaii) |
| <i>J. indica</i> Müller, 1991a (Sri Lanka) |
| <i>J. integra</i> Kensley, 1984b (South Africa) |
| <i>J. intermedia</i> Nordenstam, 1933 (Argentina) |
| <i>J. juvenilis</i> Kensley, Ortiz and Schotte, 1997 (Cuba) |
| <i>J. lata</i> Kussakin, 1961 (Sea of Okhotsk) |
| <i>J. legrandi</i> Juchault, 1962 (Mediterranean) |
| <i>J. letourneuri</i> Müller, 1990a (Réunion) |
| <i>J. lobata</i> Richardson, 1899 (California) |
| <i>J. marionis</i> Beddard, 1886 (Marion I.) |
| <i>J. mediterranea</i> Amar, 1961 (Mediterranean) |
| <i>J. meteor</i> Müller, 1991b (Gulf of Aden) |
| <i>J. minuta</i> Müller, 1989a (Society Is) |
| <i>J. monsmarinus</i> Kensley, 1980 (Vema Seamount) |
| <i>J. montalentii</i> Fresi, 1968 (Mediterranean) |
| <i>J. neozealanica</i> Chilton, 1892 (New Zealand) |
| <i>J. nigricapitis</i> Kensley, 1994 (Bermuda) |
| <i>J. palliseri</i> Hurley, 1957 (New Zealand) |
| <i>J. paradubia</i> Müller, 1989b (Columbia) |
| <i>J. pavolensis</i> Vanhöffen, 1914 (Antarctica) |
| <i>J. patagoniensis</i> Richardson, 1909 (Patagonia) |
| <i>J. personata</i> Kensley, 1984a (Belize) |
| <i>J. polynesiensis</i> Müller, 1989a (Society Is) |
| <i>J. rathbunae</i> Richardson, 1902 (Bermuda) |
| <i>J. salvati</i> Müller, 1989a (Society Is) |
| <i>J. sanctipanli</i> Kensley, 1989 (St Paul I.) |
| <i>J. schoelcheri</i> Müller, 1993 (Martinique) |
| <i>J. serrulus</i> Kensley, 1984b (South Africa) |
| <i>J. setosa</i> George and Strömberg, 1968 (San Juan Archipelago) |
| <i>J. stebbingi</i> Kensley, 1975 (South Africa) |
| <i>J. tayrona</i> Müller, 1989b (Columbia) |
| <i>J. tobagoensis</i> Kensley & Schotte, 1994 (Tobago) |
| <i>J. imidentata</i> Kensley, Ortiz and Schotte, 1997 (Cuba) |
| <i>J. vibicaria</i> Barnard, 1965 (Gough I.) |
| <i>J. waltervadi</i> Kensley, 1975 (South Africa) |
| <i>J. wolffi</i> Müller, 1991b (Gulf of Aden) |

Table 2. Comparison of characters in *Joeropsis* and the four new species described herein.

| Character | <i>Joeropsis</i> spp. ¹ | <i>Joeropsis</i> <i>bicarinata</i> | <i>Rugojoeropsis</i> <i>rugosa</i> | <i>Scaphojoeropsis</i> <i>multicarinata</i> | <i>Scaphojoeropsis</i> <i>kimblae</i> |
|---|---------------------------------------|---------------------------------------|---------------------------------------|--|--|
| Body | | | | | |
| 1. Body with subparallel margins one or more of pereonites 2-4 occasionally slightly broader than 1 and succeeding ones, particularly in brooding females | (45) ² | x | x | | |
| — Body fusiform, distinctly tapering from pereonite 2/3 to apex of pleotelson | | | | x | x |
| 2. Cuticle smooth (setae not considered) | (45) | x | | | |
| — Cuticle roughly calcified | | | x | x | x |
| 3. Without dorsal ornamentation on pereon | (44) | | | | |
| — With two broad, rounded longitudinal dorsal ridges on pereonites 1-4(5) | (1) | | | | |
| — With two parallel, sharp longitudinal dorsal keels along entire pereon and onto pleotelson | | x | | | |
| — With variety of humps and short ridges | | | x | x | x |
| Cephalon | | | | | |
| 4. Without dorsal ornamentation | (45) | x | | | |
| — With middorsal humps | | | x | | |
| — With anterior and dorsal ridges | | | | x | x |
| 5. Anterior margin between antennae not depressed (Fig. 2) | (45) | x | x | | |
| — Anterior margin between antennae strongly depressed relative to dorsal side of cephalon (Fig. 14e) | | | | x | x |
| 6. Pseudorostrum in lateral view with apical projection (Fig. 2) | (43) | x | | | |
| — Pseudorostrum in lateral view without apical projection (Fig. 9el) | | | x | | |
| — Pseudorostrum attached to depressed anterior margin of cephalon in nearly vertical position (Fig. 14c) | | | | x | x |
| Eyes | | | | | |
| 7. With dorsolateral eyes on low bulge | (45) | x | x | | |
| — Blind, without remnants of eye bulge | | | | x | x |
| Pereopods | | | | | |
| 8. Dactylus with 2 claws | (11) | x | x | x | x |
| — Dactylus with 3 claws at least on pereopods 2-7 | (28) | | | | |

Table 2. Continued.

| Character | <i>Joeropsis</i> spp. ¹ | <i>Joeropsis</i> <i>bicarinata</i> | <i>Rugojoeropsis</i> <i>rugosa</i> | <i>Scaphojoeropsis</i> <i>multicarinata</i> | <i>Scaphojoeropsis</i> <i>kimblae</i> |
|---|---------------------------------------|---------------------------------------|---------------------------------------|--|--|
| Mouthparts | | | | | |
| 9. <i>Upper lip</i> evenly rounded, less than twice as wide as long (Fig. 4 ul) | (6) | x | x | | |
| — <i>Upper lip</i> weakly convex, more than twice as wide as long (Fig. 20 ul) | | | | x | x |
| 10. <i>Mandible cutting edge</i> with strong teeth in curved, regular row (Fig. 4 md) | (40) | x | x | | |
| — <i>Mandible cutting edge</i> divided into two parts, large terminal tooth pointing forward, posterior teeth on broad flange pointing mediad to backwards (Fig. 16 md) | | | | x | x |
| 11. <i>Mandibular raker</i> setae long, in regular row (Fig. 4 md) | (40) | x | x | | |
| — <i>Mandibular raker</i> setae short, sparse, in irregular or unusual configuration (Fig. 16 md) | | | | x | x |
| 12. <i>Mandibular palp article 3</i> with apical and subapical setae (Fig. 4 md) | (31) | x | x | | |
| — <i>Mandibular palp article 3</i> with apical setae only (Fig. 20 md) | | | | x | x |
| 13. <i>Lower lip</i> , lobes longer than wide, distally tapering, pointed (Fig. 4 ll) | (6) | x | x | | |
| — <i>Lower lip</i> , lobes wider than long, rectangular, lateral corner projecting, pointed (eg. Fig. 20 ll) | | | | x | x |
| 14. <i>Maxilla 1 outer plate</i> with 12 dentate setae | (17) | x | x | | |
| — <i>Maxilla 1 outer plate</i> with 11 dentate setae | (11) | | | | |
| — <i>Maxilla 1 outer plate</i> with 10 dentate setae | (4) | | | x | x |
| — <i>Maxilla 1 outer plate</i> with 9 dentate setae | (1) | | | | |
| — <i>Maxilla 1 outer plate</i> with 8 dentate setae | (2) | | | | |
| 15. <i>Maxillipeds</i> covering at least 2/3 of ventral width of cephalon, overreaching other mouthparts (Fig. 3 c) | (37) | x | x | | |
| — <i>Maxillipeds</i> covering about 1/3 of ventral width of cephalon; do not reach anterior margin of cephalon to fully cover other mouthparts (Fig. 15 c) | • | • | | x | x |
| 16. <i>Maxilliped basis</i> reaching to apex of or beyond palp ar. 3 (Fig. 3 mp) | (37) | x | x | | |
| — <i>Maxilliped basis</i> reaching to middle of palp ar.2 (Fig. 20 mp) | | | | x | x |

Table 2. Continued.

| Character | <i>Joeropsis</i> spp. ¹ | <i>Joeropsis</i> <i>bicarinata</i> | <i>Rugojoeropsis</i> <i>rugosa</i> | <i>Scaphojoeropsis</i> <i>multicarinata</i> | <i>Scaphojoeropsis</i> <i>kimblae</i> |
|--|---------------------------------------|---------------------------------------|---------------------------------------|--|--|
| 17. <i>Maxillipedal palp</i> about 1/2 length of basis (Fig. 11 mp) | (38) | x | x | | |
| — <i>Maxillipedal palp</i> about 80–90% length of basis (Fig. 16 mp) | | | | x | x |
| 18. <i>Maxillipedal palp article 3</i> unproduced medially | (39) | x | x | | |
| — <i>Maxillipedal palp article 3</i> strongly produced medially | | | | x | x |
| 19. <i>Maxillipedal palp article 4</i> longer than 3 | (40) | x | x | | |
| — <i>Maxillipedal palp article 4</i> shorter than 3 | | | | x | x |
| Pleopods | | | | | |
| 20. <i>Female pleopod 2</i> without long apical setae (Fig. 11 pl2) | (29) | x | x | | |
| — <i>Female pleopod 2</i> with long apical setae (Fig. 19 pl2) | | | | x | x |
| 21. <i>Pleopod 3</i> exopod articulation strongly oblique (Fig. 6, 3) | (33) | x | x | | |
| — <i>Pleopod 3</i> exopod articulation transverse or nearly so (Fig. 21 pl3) | | | | x | x |

¹ Species of *Joeropsis* described prior to this study.

² Number in parentheses: number of species in which character condition could be confirmed.

the species of *Joeropsis* were found to share a character, with none found to differ (characters 1, 2, 4, 5, 6, 7, 10, 11, 12, 15, 16, 17, 19, 21), that character is considered to be shared by all species. Comments are presented below for remaining characters.

Character 3 (dorsal sculpture). *Joeropsis walteri* and the new species *J. bicarinata* differ from all other species of *Joeropsis* in having two longitudinal ridges running along the dorsum, broadly rounded and confined to the pereon in the former, and sharp keels extending to the pleotelson in the latter. The homology of these two sculptural expressions is not clear. The dorsal sculpture on the pereon and pleotelson of the other three new species differs distinctly from that in the two species of *Joeropsis*.

Character 8 (number of pereopodal claws). Eleven species of *Joeropsis* are described and/or illustrated as having two daetylar claws on all pereopods, 28 as having three claws at least on pereopods 2–7. Generally only one or two pereopods are illustrated, and in several instances text and illustrations do not match. Where three claws are illustrated, the accessory claw is distinct and

of similar shape to the two terminal ones. Boequet and Lemereier (1958), in their redescription of the type species *J. brevicornis* Kochler, state that pereopod 1 carries two daetylar claws, all other pereopods carry three claws, as shown in their illustrations of pereopods 1 and 7. Similarly, several species, e.g. *J. intermedius* Nordenstam and *J. patagoniensis* Richardson are described and illustrated (Nordenstam, 1933) as having two claws on pereopod 1 and three on the rest of the pereopods. Amar (1961) described and illustrated *J. mediterranea* as having two claws on all pereopods (pereopods 1, 2 and 6 illustrated). The four species described in this study have two claws only on all pereopods. *J. mediterranea*, as well as the four new species, carry small, simple setae on the lateral and medial surfaces of the daetylus (not known or difficult to interpret in all other species with two claws only). Homology between one such seta and a distinctive accessory claw cannot be ruled out (Wilson, 1994). While two claws on pereopod 1 and three on pereopods 2–7 may be more common in *Joeropsis* than two claws on all pereopods, the character is useful only at the species level pending further comparative studies.

I am not aware that a similar dichotomy in the number of fully developed pereopodal claws has been reported in other janiroid genera.

Character 9 (upper lip). The upper lip in *J. brevicornis* (see Boequet and Lemercier, 1958), five other species of *Joeropsis* and two of the new species is evenly rounded, about 1.5 times as wide as long. The upper lip has not been described or illustrated for other species of *Joeropsis*. In the other two new species, the upper lip is less rounded and about 2.5 times wider than long. More information is required to fully evaluate the generic significance of these differences, but the character has been included tentatively in the diagnoses of genera.

Character 13 (lower lip). In six species, including *J. brevicornis*, plus in two of the new species, the lobes of the lower lip are longer than wide, curving mediad and tapering to a more or less acute apex (no information is available for other species of *Joeropsis*). This shape is common to most janiroids and is tentatively considered to be shared by all species in *Joeropsis*. In two of the new species, the lower lip differs significantly, lobes being rectangular, broader than long, with projecting lateral corners.

Character 14 (maxilla 1 outer plate). In 34 species of *Joeropsis* the number of apical spine-like setae on the outer plate of maxilla 1 is given in text and/or illustration. The numbers given are 12 (17 species), 11 (11), 10 (4), 9 (1) and 8 (2). It is not clear, however, whether numbers have been enumerated in a consistent manner, i.e., large denticulate setae only, or smaller simple setae included, where these occur, (cf. Fig. 4 m1: 12 dentate + 2 small simple and Fig. 16 m1: 10 + 3). In several cases, the number given in the text and the number illustrated do not agree, e.g. *J. hawaiiensis* Miller (text: 6, illustration: 8). Clear evidence of considerable interspecific variation in the number of denticulate setae occurs within *Joeropsis*, but further comparative studies are required before its significance can be ascertained. Numbers given in descriptions of the new species do not include the small simple setae.

Character 18 (maxillipedal palp article 3). In 40 species of *Joeropsis*, the third article of the maxillipedal palp is unproduced medially (see Fig. 3 mp). *J. santipauli* Kensley has a slight expansion medially on article 3. The two species referred to *Scaphojoeropsis* gen. nov. have distinctive medial lobes on article 3. This character may be useful in separating genera.

Character 20 (female pleopod 2). In 20 species of *Joeropsis* illustrations show that the distal fifth to four-fifths of the lateral margins of pleopod 2

in females are densely fringed with what has been described as 'setules' or 'setae' (see below: cuticular scales). No long true setae occur apically. In another nine species where the female pleopod 2 is not illustrated, pleopod 2 of the male is shown to carry similar lateral 'setules/setae'. Evidence from *Joeropsis bicarinata* sp. nov. (Fig. 5) suggests that the 'setal' fringe is similar in male and female in species of *Joeropsis*. Presence of this fringe, and absence of long apical setae on the female opereulum, (a few short simple setae may be present), may be characteristic for all species of *Joeropsis*. *Rugojoeropsis rugosa* gen. nov., sp. nov. has a similar fringe to *Joeropsis* on male and female pleopods 2. *Scaphojoeropsis multicarinata* sp. nov. has an almost invisible fringe in the distalmost tenth of both female and male pleopod 2. Pleopod 2 of male *S. kimblae* sp. nov. has a fringe along nearly the entire lateral margin (not verified in females). Both species of *Scaphojoeropsis* carry a row of long simple setae apically on pleopod 2. The presence of lateral 'setules/setae' appears to be ubiquitous in *Joeropsididae*, whereas the presence of long apical setae appears to be confined to *Scaphojoeropsis*.

Additional remarks on morphology

Rostral projection. Wilson (1989: 130) defined the asellote rostrum as 'a projection of the cephalic frons that may also include the dorsal surface of the cephalon.' Serov and Wilson (1995: 41) proposed the following definition 'any anterior extension from the frons or vertex [midanterior dorsal cephalic margin] of the cephalon.' While a rostrum derived from the vertex generally will incorporate the upper frons along its ventral side, a projection derived from the frons normally does not involve an extension of the vertex. Whether the dorsoposterior margin of a frons-derived projection could fuse with the cephalic vertex, thus obscuring the origin of the rostrum, is not clear. For the purposes of phylogenetic analyses, discriminating between a true rostrum, being an extension of the cephalic vertex, and a frons-derived *pseudorostrum* may be useful. All species in *Joeropsididae* possess a pseudorostrum, and that term is used throughout this study. All species in *Joeropsis* and *Rugojoeropsis* have the cephalic vertex concavely recessed, with the pseudorostrum fitting into, and projecting from, the recession. In *Joeropsis*, the pseudorostrum projects straight forward over the inferior parts of the frons (see Fig. 2 habitus, lateral view). In *Rugojoeropsis* the pseudorostrum forms a box-like hump without an apical projection (Fig. 9 cl). In *Scaphojoeropsis* the

pseudorostrum borders the vertex along a straight line, is broadly rounded apically, and angled downwards (see Fig. 14 c).

Cuticular scales. In most instances where pleopod 3 has been illustrated in species of *Joeropsis*, the exopod is shown with a dense fringe of thin, simple setae. The four species described here have complex, flattened, often overlapping cuticular scales (arising as outgrowths from the cuticle, not inserted into it like setae, see, e.g., Fig. 6, 3) along the entire margin of the exopod. This character is not confined to these four species because it occurs in *J. mediterranea* (Amar, 1961: fig. 3) and *J. salvati* (Müller, 1989a: fig. 75). The scales are so transparent that normally they can be seen in their entirety only with the aid of Nomarski or phase contrast. With ordinary light microscopy, only the slightly strengthened posterior edge of the individual scale usually is visible (as a thin, simple setule). These scales vary in form and size between species as evidenced by the four species described below. They are likely to be present in all species of Joeropsididae. The fringe of reported 'setules/setae' on the lateral margin of pleopod 2 in females and males in Joeropsididae consists of similar cuticular scales (e.g. Figs 5H and 11pt).

Female reproductive structures. With the exception of male pleopods 1 and 2, the literature does not provide information on reproductive structures in Joeropsididae. A preparatory female of the new species *Scaphojoeropsis multicarinata* allows some preliminary comments to be made (Fig. 1). The elongate ovaries reach from the anteriormost part of peronite 1 through to peronite 6. The oviduct attaches to the ventral side of the ovary in the middle of pereonite 3, curves laterad and posteriad, and opens ventrally on pereonite 5 mediad to the coxa. The spermathecal duct appears to open on the anterior surface of pereonite 5, from where it curves into pereonite 4 and runs straight to the middle of pereonite 3 to join the oviduct in a common opening to the ovary. In the specimen illustrated, the anteriormost portion of the spermathecal duct is slightly inflated and filled with denser material. A single female of the new species *Rugojoeropsis rugosa* has a similar configuration.

Conclusion

Joeropsis bicarinata sp. nov. differs from other species in the genus as currently conceived only in the presence of two sharp, longitudinal dorsal keels. A possibly intermediate condition between those keels and the normally smooth dorsum in

Joeropsis is seen in the low, rounded ridges in *J. waltervadi*. *J. bicarinata* is referred to *Joeropsis*.

The second new species shares with *Joeropsis* all characters analysed in Table 2 except for the rough, calcified cuticle, dorsal sculpture in the form of humps and transverse ridges, and the box-shaped, unproduced pseudorostrum. Since all species of *Joeropsis* possess a smooth cuticle and straight, overhanging pseudorostrum, a new genus *Rugojoeropsis* is justified. The remaining two new species differ in many characters from *Joeropsis* and *Rugojoeropsis* (Table 2), notably in the shape of the cephalon and pseudorostrum, the shape of the entire body, and details of mouthparts. They too warrant a new genus, *Scaphojoeropsis*.

Joeropsididae Nordenstam

Jaeropsini Nordenstam, 1933: 190.

Jaeropsidae.—Menzies, 1962: 63.—Menzies and Kruczynski, 1983: 94.

Joeropsididae.—Sivertsen and Holthuis, 1980: 96 (correction of spelling).—Kussakin, 1999: 10.

Diagnosis. Janiroidea with flattened body; lateral margins normally parallel, occasionally tapering posteriorly. Peronites of subequal length, with truncate, entire or at most finely serrate, lateral margins covering coxae. All pereopods similar, slender, ambulatory, with 2 or 3 dactylar claws. Sessile eyes normally present in dorsolateral position on cephalon. Anterior margin of cephalon with strong concavity, or rarely without concavity. Pseudorostrum present, inserted into cephalic concavity, rarely joined along straight line. Pleotelson subequal in width to peronite 7, with no free pleonites. Antenna 1 shorter than cephalon, peduncular article 1 expanded, longer than articles 2 and 3 combined; flagellum shorter than peduncle, with 2 or 3 articles, rarely 4 (one species herein) or 5 (*Joeropsis sanctipauli* and one species herein). Antenna 2 geniculate, with peduncular article 6 and flagellum folding laterad and backwards under lateral expansion of peduncular article 5; first 4 peduncular articles short, article 4 more or less telescoped into 3, article 5 longer than 1–4 combined, greatly expanded laterally, article 6 much shorter than 5, generally widening distally; antennal scale absent; flagellum with enlarged, normally conjoint article 1. Mandible molar a long, slender, pointed projection; incisor of 5–6 large teeth, (occasional small accessory denticles not counted); laeina mobilis absent; palp with 3 articles. Maxillipeds, palp with 5 articles, at least article 2 medially expanded. Pleopod 2 of male and female with

longer or shorter lateral fringe of modified cuticular scales; pleopod 3 exopod 2-articulate, longer than endopod, with lateral fringe of modified cuticular scales, endopod with 3 plumose setae; pleopod 4 exopod vestigial. Uropods biramous, inserted ventrally on pleotelson normally within distinctive insinuation in pleotelson margin; peduncle usually broader than long and medially expanded; rami shorter than peduncle. Anus outside pleopodal chamber, between bases of uropodal peduncles, partly or entirely covered by male pleopod 1 or female pleopod 2 respectively. Oostegites on percopods 1–5. Female spermathecal duct opening on anterior surface of peronite 5, oviduct opening ventral on peronite 5 mediad to coxa.

Included genera: *Joeropsis* Kochler, 1885, *Rugojoeropsis* gen. nov., *Scaphojoeropsis* gen. nov.

Joeropsis Kochler

Joeropsis Kochler, 1885: 1.—Sivertsen and Holthuis, 1980: 96.—Kussakin, 1999: 12.

Jacropsis.—Nordenstam, 1933: 191.—Menzies and Barnard, 1959: 10.—Menzies, 1962: 63. (unjustified emendation).

Iaeropsis.—Nierstrasz, 1941: 288 (unjustified emendation).

Type species. *Joeropsis brevicornis* Kochler, 1885 (by monotypy).

Diagnosis. Joeropsidae with lateral body margins parallel, rarely with dorsal sculpture. Cuticle smooth. Cephalon with anterior margin strongly concave. Pseudorostrum inserted into concavity, flush with dorsal surface of cephalon, with overhanging apex. Dorsolateral eyes present. Upper lip evenly rounded, less than twice as wide as long. Mandibles with incisor of 5 or 6 strong subequal teeth in regular, curved row; spine row setae long, in regular row. Lower lip, lobes longer than wide, distally tapering, pointed. Maxillipeds in ventral view covering at least two-thirds of cephalic width, and covering other mouthparts except for medioapical concavity; endite reaching to end of or beyond palp article 3; palp about half length of endite; palp article 3 without medial lobe, (*J. sanctipauli*, with a small medial lobe, appears to be an exception), article 4 much longer than 3. Pleopod 2 of female with at most a few short simple setae apically. Pleopod 3 exopod with strongly oblique articulation between articles.

Included species. See Table 1.

Joeropsis bicarinata sp. nov.

Figures 2–7

Material examined. Holotype. Vic. Bass Strait, S of Point Hicks, 38°17.70'S 149°11.30'E, 400 m, coarse sand, gravel, mud, many sponges, WHOI epibenthic sled, M.F. Gomon et al., 24 Jul 1986, ORV Franklin (stn SLOPE-40), NMV J18685 (female, 4.8 mm, with including 6 slides).

Paratypes (43 specimens). NSW. E of Newcastle, 32°53'S 152°35'E, 146–175 m, 15 Aug 1985, FRV *Kapala* (stn K85-12-23), AM P38889 (5). Off Eden, 36°57.40'S 150°18.80'E, 220 m, muddy shell, WHOI epibenthic sled, G.C.B. Poore et al., 20 July 1986, ORV *Franklin* (stn SLOPE-21), NMV J18681 (14). Off Eden, 37°0.60'S 150°20.70'E, 363 m, coarse shell, WHOI epibenthic sled, G.C.B. Poore et al., 21 July 1986, ORV *Franklin* (stn SLOPE-22), NMV J18682 (1).

Vic. Bass Strait, S of Point Hicks, 38°17.70'S 149°11.30'E, 400 m, coarse sand, gravel, mud, many sponges, WHOI epibenthic sled, M.F. Gomon et al., 24 Jul 1986, ORV *Franklin* (stn SLOPE-40), NMV J18683 (1), NMV J27641 (1 male, pleotelson and pleopods 1–5 illustrated, 2 slides), NMV J18684 (2). 50 km S of Mallacoota, 38°06.2'S 149°45.5'E, 188 m, WHOI epibenthic sled, R. Wilson, 14 Oct 1984, FRV *Soela* (stn S05/84/30), NMV J18687 (5).

Tas. 15 km E of Mistaken Cape, Maria I., 42°37'S 148°20'E, 102 m, WHOI epibenthic sled, R. Wilson, 9 Oct 1984, FRV *Soela* (stn S05/84/1), NMV J18686 (3). 30 km NNW of Cape Sorell, 42°10.9'S 144°48.9'E, 160 m, WHOI epibenthic sled, R. Wilson, 20 Oct 1984, FRV *Soela* (stn S05/84/54), NMV J18688 (4). 25 km W of Port Davey, 45°23.3'S 145°39.8'E, 160 m, WHOI epibenthic sled, R. Wilson, 21 Oct 1984, FRV *Soela* (stn S05/84/60), NMV J18689 (6).

Description. Cephalon about third wider than midline length; pseudorostrum as long as wide, projecting to right angled point. Body without setae, dorsally with 2 sharp, parallel, longitudinal keels running on to proximal third of pleotelson. Cephalon and pereon margins smooth. Pleotelson width about 1.5 length, with medioproximal keels in continuation of peronite keels, low sinuous keels in distal half terminating laterad of uropods, lateral margins evenly curved, minutely serrate, distal margin strongly insinuated for uropods, apex between uropods rounded right angled.

Antenna 1 of up to 5 articles; article 1 rectangular, distomedial corner with small teeth, width 0.75 length, about twice as long and wide as article 2 which is twice as long and wide as 3, article 5 as long as 3, both longer than 4, article 5 with 2 aesthetascs; lateral margins of articles 1 and 2 lined with cuticular outgrowth. Antenna 2, peduncle articles 1–4 of subequal length, article 3 widest, article 4 third embedded into 3, article 5 ovate, nearly twice as long as 1–4 combined,

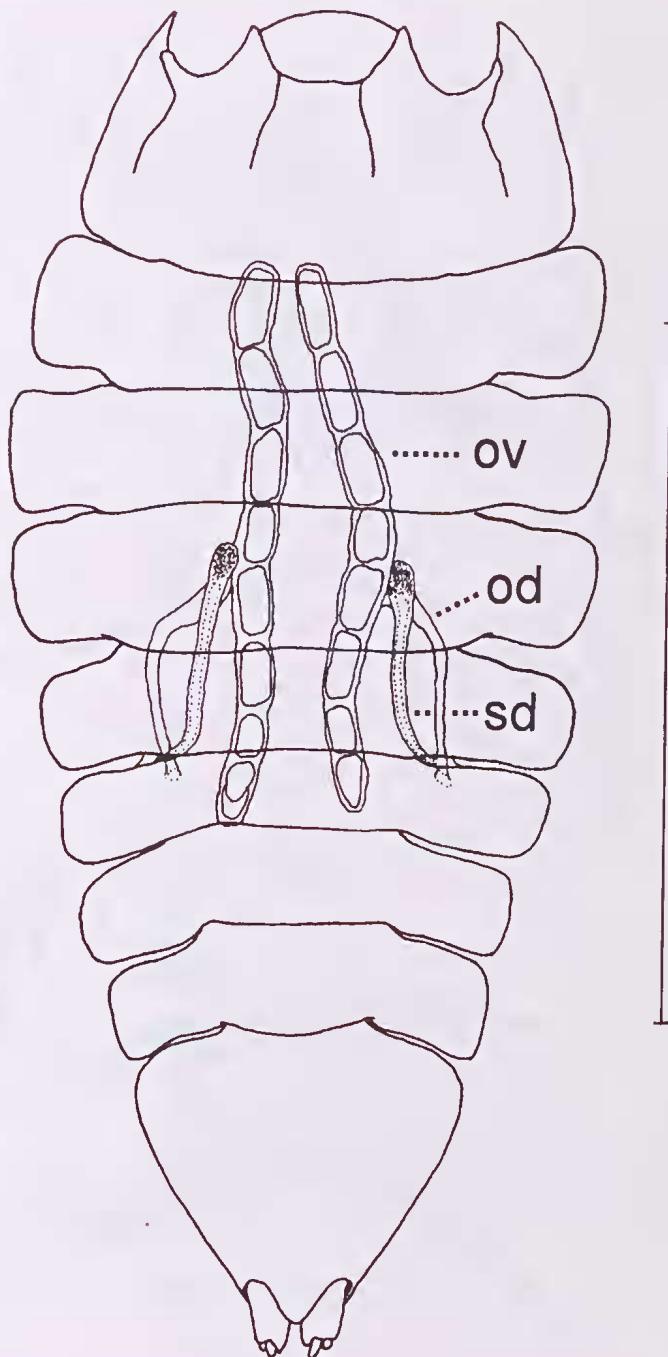


Figure 1. *Scaphojoeropsis multicarinata* gen. nov., sp. nov. Reproductive structures of preparatory female (paratype, NMV J18690), dorsal view; dorsal sculpture of body omitted; od, oviduct; ov, ovary; sd, spermathecal duct. Scale bar: 1 mm.

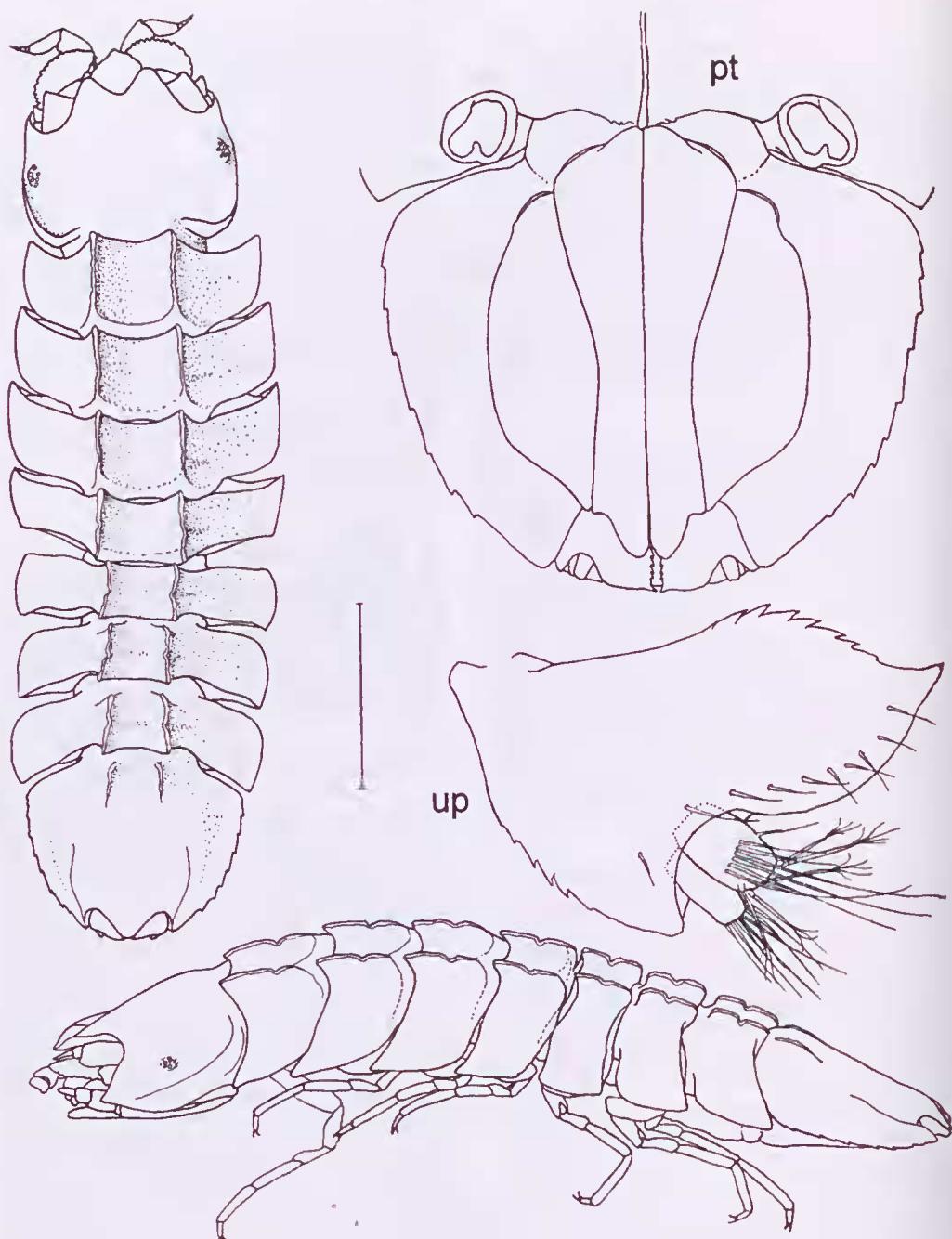


Figure 2. *Joeropsis bicarinata* sp. nov., holotype, except pt: paratype, male, (NMV J27641). pt, male pleotelson, ventral view, setae omitted; up, right uropod, ventral view. Habitus scale bar: 1 mm.

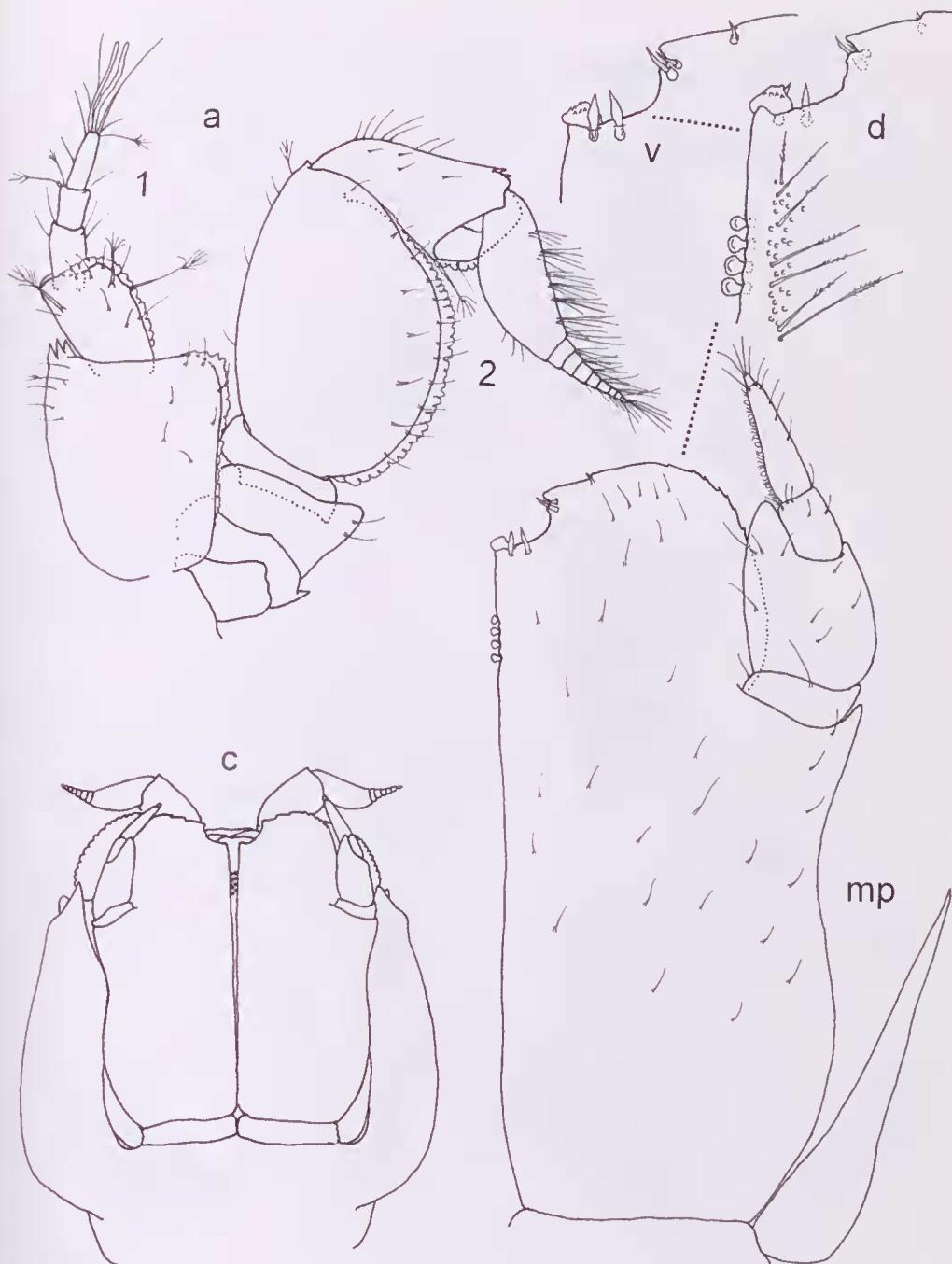


Figure 3. *Joeropsis bicarinata* sp. nov., holotype. a, right antennae 1 and 2, dorsal view; c, ventral view of cephalon, setae omitted; mp, maxilliped, with enlarged ventral (v) and dorsal (d) view of mediodistal part of endite.

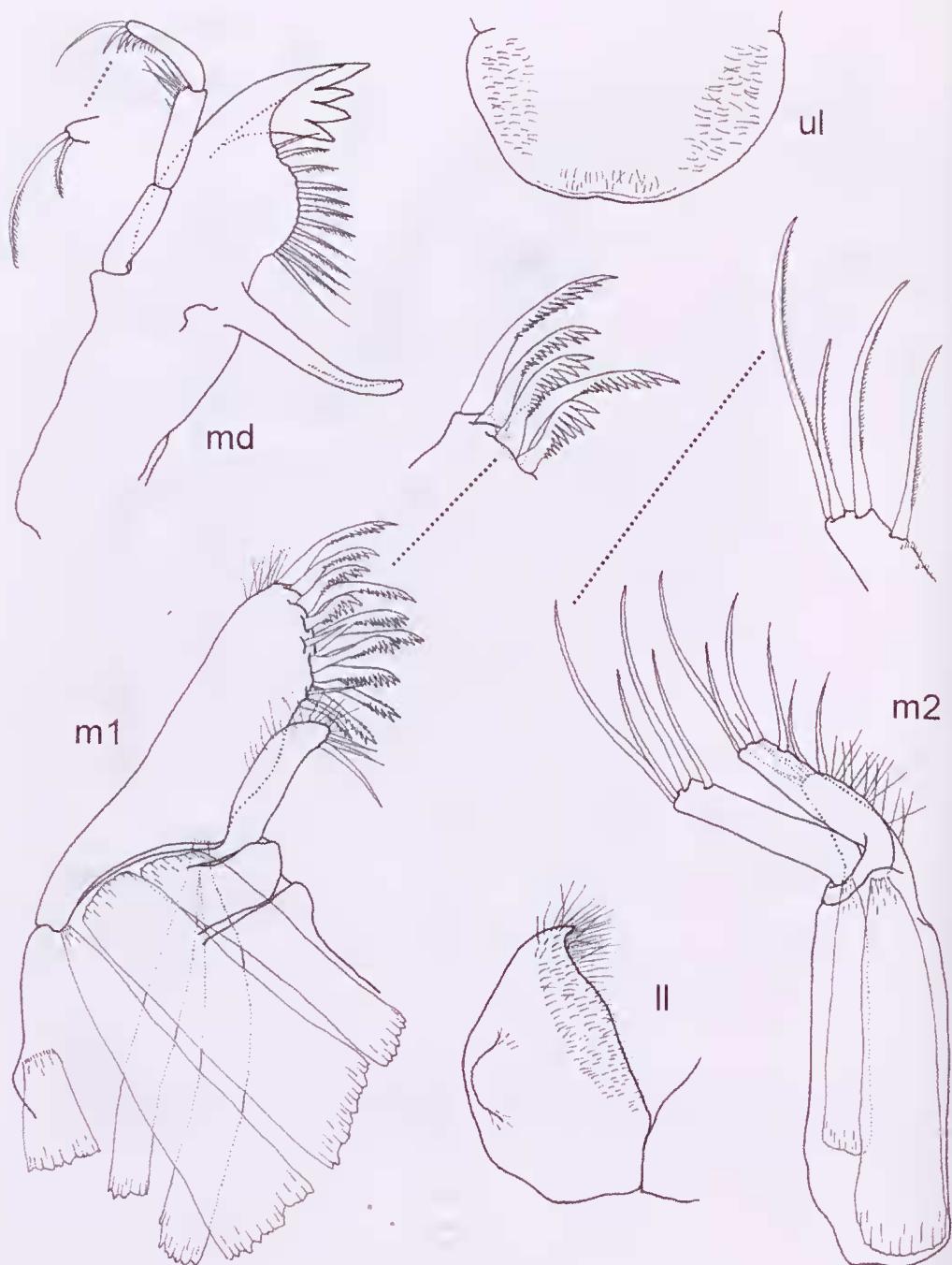


Figure 4. *Joeropsis bicarinata* sp. nov., holotype. **II**, lower lip; **md**, mandible; **m**, maxilla (1 and 2); **ul**, upper lip.

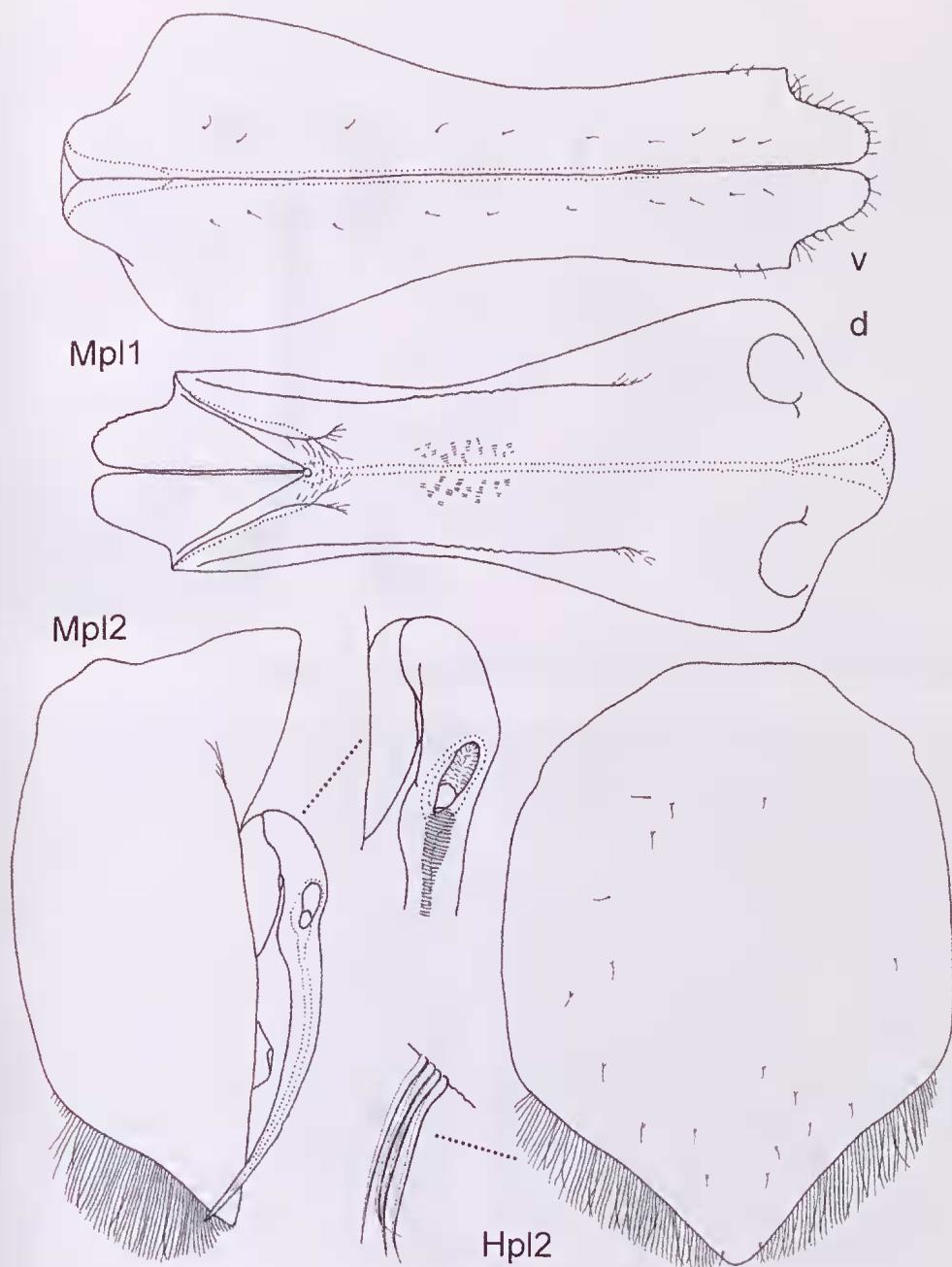


Figure 5. *Joeropsis bicarinata* sp. nov. **M**, paratype, male, (NMV J27641). **H**, holotype. **pl**, pleopod (I and 2); **d**, dorsal and **v**, ventral view.

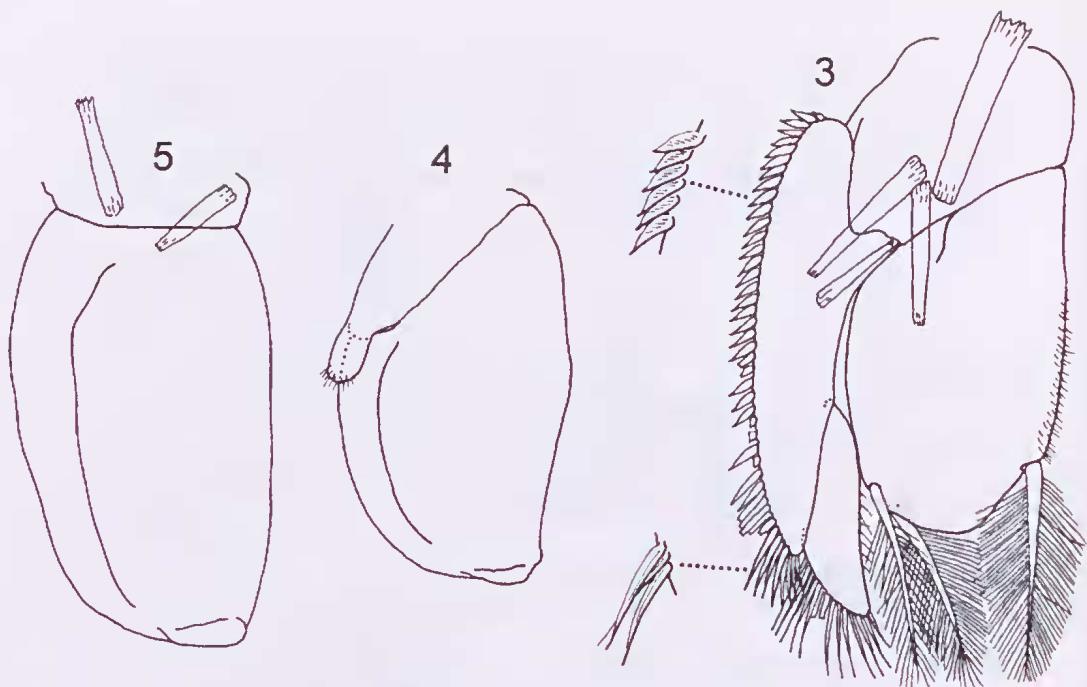


Figure 6. *Joeropsis bicarinata* sp. nov., paratype, male, (NMV J27641). Pleopods 3–5.

width two-thirds length, lateral margin fringed with cuticular outgrowth, article 6 as long as 1–4 combined, distally expanded; flagellum about fifth longer than peduncle article 6, with up to 10 artieles, article 1 inflated, conjoint, twice length of remaining artieles combined.

Mouthparts: Mandibles, palp reaching apex of 5-dentate incisor, artieles of subequal length, artiele 2 with distal tuft of long pectinate setae, artiele 3 with terminal long pectinate seta and subapical row of successively shorter similar setae along distal half of artiele. Maxilla 1 outer plate with 12 coarsely dentate setae and 2 shorter, slender, simple setae; inner plate third width of outer plate, reaching to mediodistal corner of outer plate, with 3 long, simple setae and many long setules distally. Maxilla 2, all 3 plates with 4 long, curved, finely pectinate setae, outer and middle plates of similar shape and length, over-reaching inner plate with about third length, inner plate with many long setules medially. Maxillipeds covering about 0.6 ventral width of cephalon, reaching forward beyond upper lip, basis twice as long as greatest width, endite reaching to proximal third of palp artiele 4, with scattered simple setae on ventral surface and dorsal field of slender, plumose setae inside medial margin, mediodistal concavity of endite with 1

medial lump-shaped seta and a few short spear-head-shaped setae, apical and lateral margins evenly rounded, finely serrate; palp artiele 2 three times longer than 1, with bluntly triangular, forward pointing medial lobe reaching apex of artiele 3, artiele 3 0.4 length of distally tapering artiele 4, medial surface of artiele 4 covered with short setules, artiele 5 minute; epipod about as long as palp, narrow, tapering to acute point.

Pereopods slender, similar, with 2 elaws; basis about 4 times longer than wide, twice length of ischium, 2–7 with two penicillate setae in proximal half; merus about 0.8 length of ischium, dorso-distally expanded; carpus slightly wider than and of subequal length to propodus, ventrodistal corner with group of acute, forward pointing spines; propodus with 3 to 4 slender, robust setae along ventral margin, single penicillate seta dorso-epically; daetylus of pereopod 1 about quarter length of propodus, twice as long as wide, of pereopods 2–7 about third length of propodus, about 2.5 times longer than wide, dorsal and ventral claws of equal length, dorsal elaw more slender.

Pleopods: Male pleopod 1 2.5 times longer than greatest width, strongly tapering towards midlength, margins only slightly diverging distal to midpoint, apical lobes broadly rounded, set off

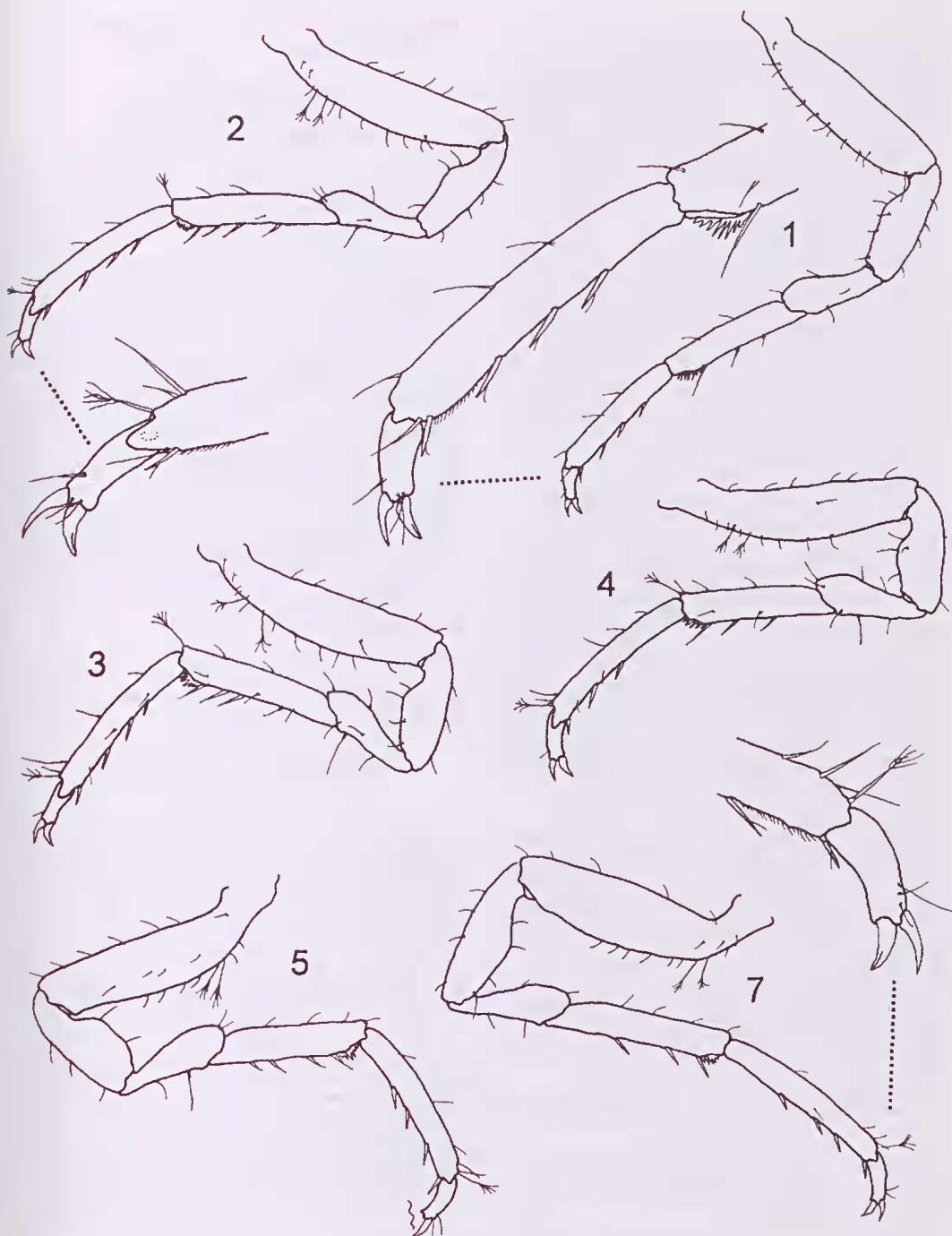


Figure 7. *Joeropsis bicarinata* sp. nov., holotype. Pereopods 1-5 and 7.

from lateral margins by pointed right angle, apical lobes fringed with short, simple setae; dorsal surface with simple stylet guides running from sperm duct opening to right-angled lateral corners; mid-dorsal surface with oval field of tiny setules, ventral surface with 2 longitudinal rows of short, simple setae. Male pleopod 2, protopod 2.5 times longer than midwidth, proximal two-thirds of lateral margin faintly convex, naked, distal third curved mediad, slightly concave, with dense fringe of long, thin cuticular scales, apex pointed; stylet evenly curved, in retracted position reaching to apex of protopod. Female pleopod 2, shaped like combined protopods of male pleopod 2, distal third triangular, lateral fringe of cuticular scales about 1.2 times longer than in male, apex rounded, ventral surface with scattered short, simple setae including a couple at apex. Pleopod 3, endopod rounded rectangular, midsurface length 1.5 times midwidth; exopod article 1 about 5 times longer than midwidth, reaching just beyond apex of endopod, lateral margin densely fringed with cuticular scales, short and broad in proximal two-thirds, longer and more slender distally; exopod article 2 articulating along medial margin of article 1, barely half length of article 1, distally tapering to blunt apex, lateral margin fringed with long, slender cuticular scales, medial margin with a few setules. Pleopod 4, endopod subequal in size and shape to endopod pleopod 3, without setae; exopod a vestigial, rounded lobe with apical setules, length about 1.3 width. Pleopod 5, similar to pleopod 4 in shape but about 1.2 times longer.

Uropods: Peduncles not reaching beyond margin of pleotelson, broadly expanded medially, mediolateral corner produced, acutely pointed, ventrodistally with row of simple submarginal setae, medial and lateral margins serrate; rami of equal length, about quarter length of lateral margin of peduncle, outer ramus twice as long as wide, with apical row of long, simple setae, inner ramus length 1.5 times width, with midventral row of long, simple setae and several apical penicillate setae.

Size. Largest male 5.5 mm; largest female 4.8 mm.

Distribution. Eastern Australia south of 33°S, eastern Bass Strait, east and west coasts of Tasmania; 102–400 m.

Etymology. The species is named for the two prominent dorsal keels.

Remarks. The dorsal keels are present in specimens as small as 2 mm, although barely raised

from the dorsal surface, but they cannot be seen in specimens of 1 mm.

Rugojoeropsis gen. nov.

Type species. *Rugojoeropsis rugosa* sp. nov.

Diagnosis. Joeropsididae with lateral body margins parallel, with humps and ridges dorsally. Cuticle roughly calcified. Cephalon with anterior margin strongly concave. Pseudorostrum inserted into concavity, box shaped, without overhanging apical projection. Dorsolateral eye bulges without ommatidia. Upper lip evenly rounded, less than twice as wide as long. Mandibles with incisor of 5 strong subequal teeth in regular, curved row; spine row setae long, in regular row. Lower lip, lobes longer than wide distally tapering, pointed. Maxillipeds in ventral view covering at least two-thirds of cephalic width, and covering other mouthparts except for medioapical concavity; endite reaching beyond palp article 3; palp about half length of endite; palp article 3 without medial lobe, article 4 much longer than 3. Pleopod 2 of female with a few tiny simple setae apically. Pleopod 3 exopod with strongly oblique articulation between articles.

Included species. *Rugojoeropsis rugosa* sp. nov.

Etymology. From the Latin *rugosus* = uneven, rough, alluding to the texture of the cuticle.

Rugojoeropsis rugosa sp. nov.

Figures 8–13

Material examined. Holotype, Tas., off Freycinet Peninsula, 41°57.50'S 148°37.90'E, 400 m, coarse shell, WHOI epibenthic sled, M.F. Gomon et al., 27 Jul 1986, ORV *Franklin* (stn SLOPE-48), NMV J18678 (preparatory female, 2.8 mm, with 5 slides).

Paratypes (29 specimens). NSW. Off Eden, 37°7.30'S 150°20.20'E, 550 m, grey coarse shell, WHOI epibenthic sled, G.C.B. Poore et al., 20 Jul 1986, ORV *Franklin* (stn SLOPE-19), NMV J18676 (1).

Tas. Off Freycinet Peninsula, 41°58.60'S 148°38.80'E, 500–600 m, coarse shell, WHOI epibenthic sled, M.F. Gomon et al., 27 Jul 1986, ORV *Franklin* (stn SLOPE-47), NMV J18677 (15, maxilliped of 1 female illustrated, 1 slide). Off Freycinet Peninsula, 41°57.50'S 148°37.90'E, 400 m, coarse shell, WHOI epibenthic sled, M.F. Gomon et al., 27 Jul 1986, ORV *Franklin* (stn SLOPE-48), NMV J18679 (1 male, pleotelson and pleopods 1 and 2 illustrated, 2 slides), NMV J18680 (12, ventral view of spent female illustrated).

Description. Cephalon twice as wide as midline length, with serrate lateral margins, with a rounded hump on each side medial to eyes; lobes

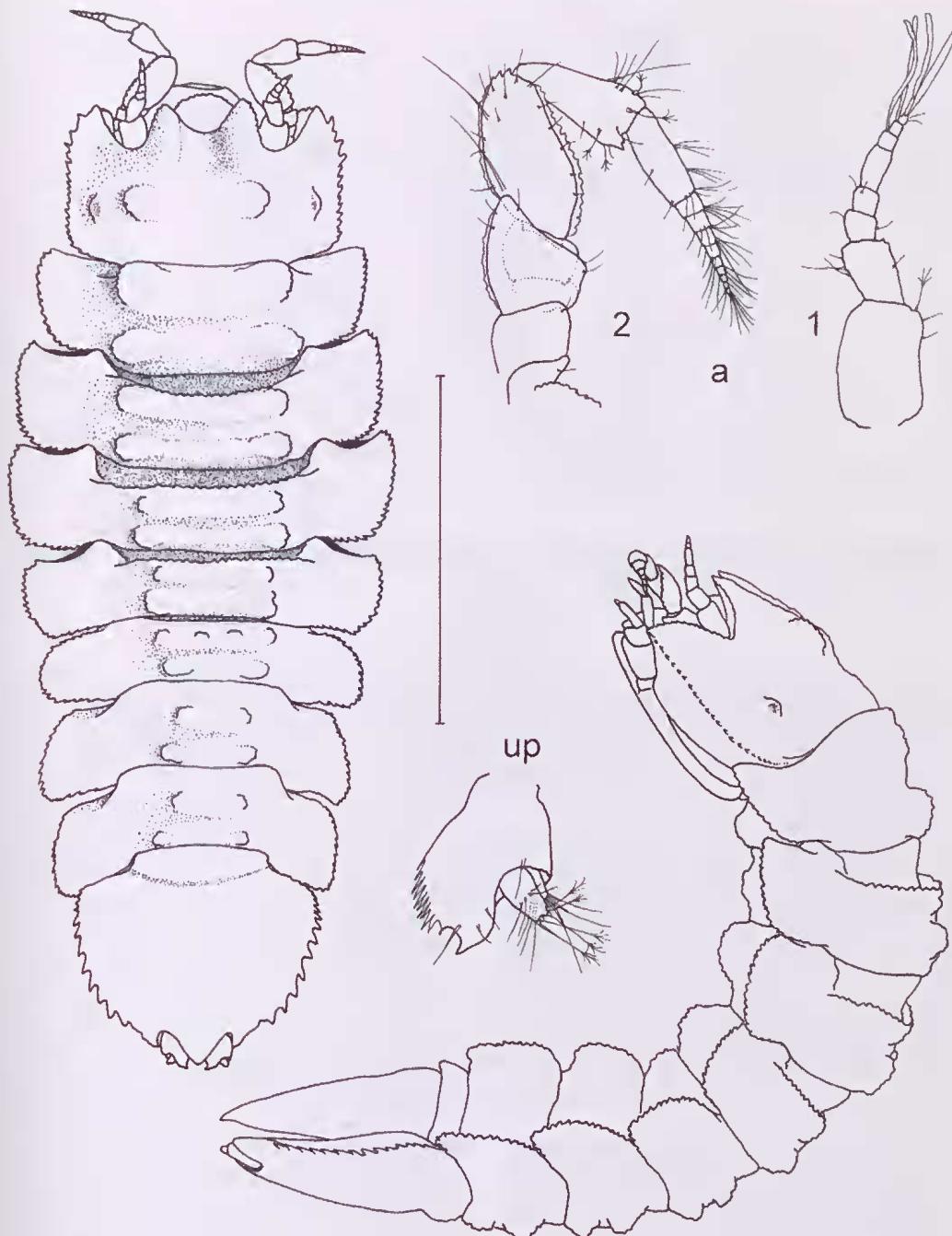


Figure 8. *Rugojoeropsis rugosa* gen. nov., sp. nov., holotype. a, antennae (1 and 2, right, dorsal view); up, uropod, left, ventral view. Habitus scale bar: 1 mm.

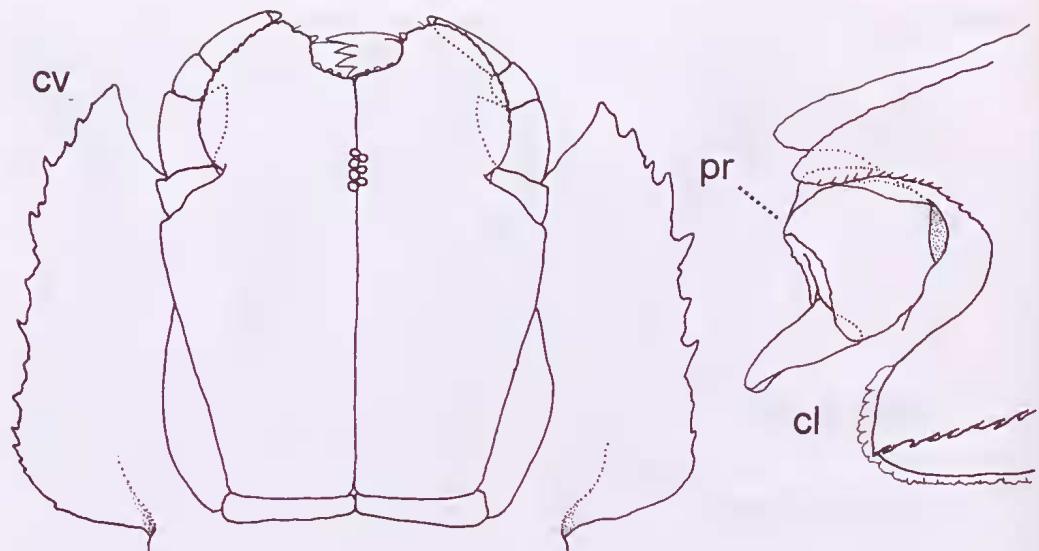


Figure 9. *Rugojoeropsis rugosa* gen. nov., sp. nov. **cl**, cephalon left lateral view (holotype); **pr**, pseudorostrum. **cv**, cephalon ventral view (paratype, spent female, NMV J18680).

surrounding midanterior sinus raised to broad, rounded keels; pseudorostrum in dorsal view with evenly convex, finely serrate anterior margin, width 1.3 length, barely reaching beyond surrounding cephalic lobes; in lateral view pseudorostrum vertically truncated, without overhanging projection.

Pereonites dorsally with 2 low, transverse, rounded ridges, lateral parts of ridges more pronounced than central parts, ridges on pereonites 1 and 2 approximately half width of segment, successively shorter on more posterior pereonites, lateral and lateroposterior margins of pereonites serrate and carrying scattered short, simple setae.

Pleotelson width about 1.1 times length, lateral margins evenly curved, coarsely serrate, distal margin strongly insinuated for uropods, apex between uropods rounded, slightly less than right angled.

Antenna 1 article 1 rectangular, reaching about halfway along cephalic sinus lobes, width two-thirds length, about twice as long as and half as wide again as article 2 which is twice as long and wide as 3; flagellum of up to 5 articles, article 1 as long as peduncular article 3, article 2 twice length of article 1 and as long as 3-5 combined, articles 3-5 each with 1 long aesthetase. Antenna 2, peduncle articles 1-3 of increasing length, article 2 rectangular, article 3 medial margin

twice as long as lateral margin resulting in strongly oblique apical margin, article 4 fully embedded into 3, subequal in size to article 2, article 5 elongate, poorly expanded laterally, as long as 1-4 combined along dorsal midline, width 0.5 length, margins fringed with cuticular outgrowth, article 6 three quarters length of 5, distally expanding; flagellum as long as peduncle articles 4 and 5 combined, with up to 10 articles, article 1 moderately inflated, conjoint, as long as remaining articles combined.

Mouthparts: Mandible palp slightly overreaching apex of 5-dentate incisor, articles 1 and 2 of equal length, article 3 two-thirds length of 2, article 2 with mediadistal row of peetinate setae, article 3 with terminal long peetinate seta and subapical row of successively shorter similar setae along distal half of article. Maxilla 1 outer plate with 12 coarsely dentate setae and 1 short, stout simple seta at midface; inner plate 0.5 width of outer plate, barely reaching mediadistal corner of outer plate, with 3 long, medioapical setae and many apical and distolateral long setules. Maxilla 2, outer and middle plates of subequal size and length about 1.3 times longer than inner plate, with 4 unequally long, straight to moderately curved, finely peetinate setae; inner plate with 3 similar setae and long medial setules. Maxillipeds covering about two-thirds of ventral width of

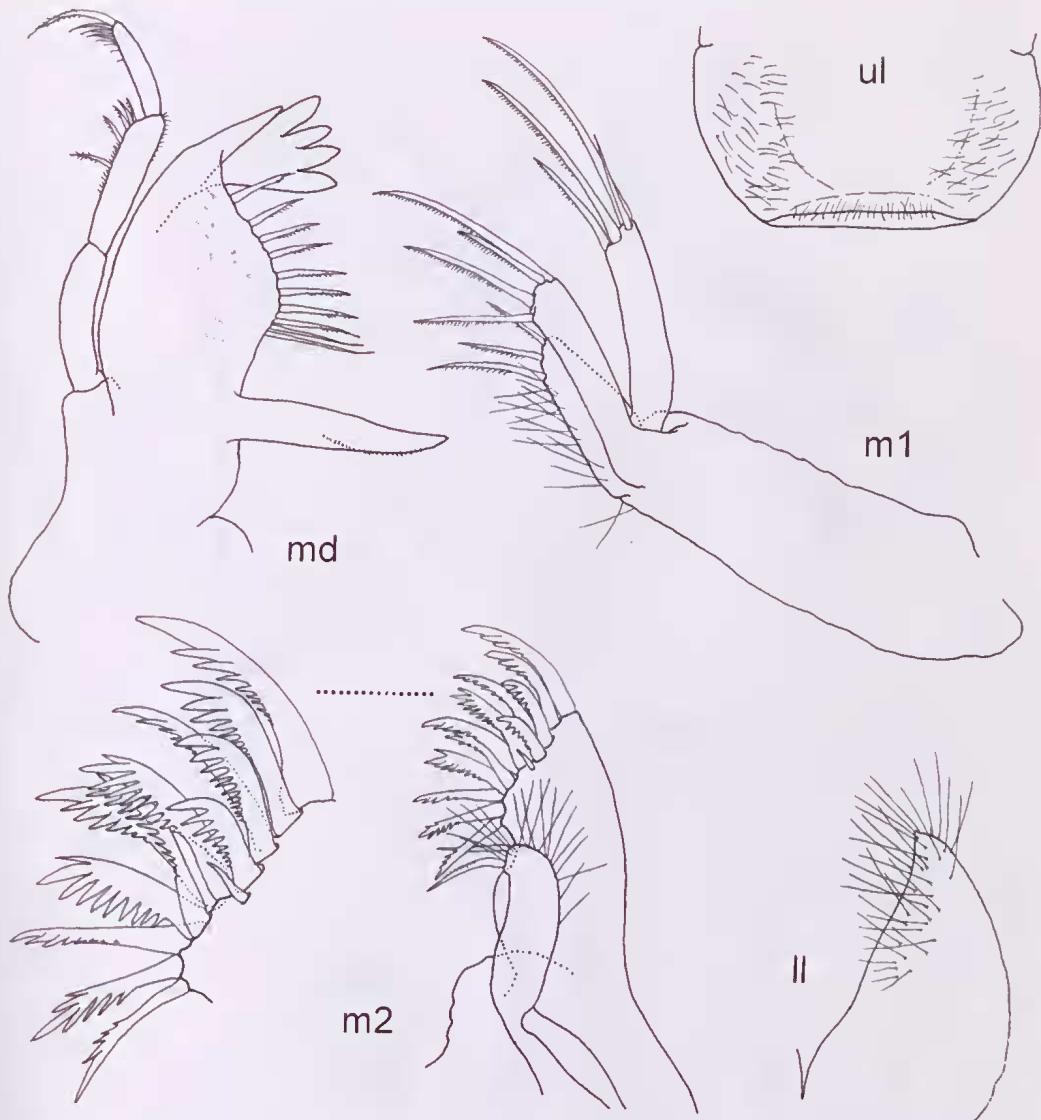


Figure 10. *Rugojoeropsis rugosa* gen. nov., sp. nov., holotype. II, lower lip; md, mandible; m, maxilla (1 and 2); ul, upper lip (apical margin folded back artificially).

cephalon, reaching forward beyond upper lip, basis twice as long as greatest width, endite reaching to about middle of palp article 4, with dorsal field of slender setules inside medial margin, mediolateral concavity with row of 4 low, lump-shaped setae; apical and lateral margins of endite evenly rounded, finely serrate, with single slender setule in each indentation and small peg-shaped seta anterior to concavity; palp article 2 three times longer than 1 along midsurface, with for-

ward pointing medial lobe reaching about two-thirds along article 3, apex of lobe with a few long slender setae, article 3 about half length of distally tapering article 4, medial margin of 2 and 3 fringed with cuticular outgrowth, medial surface of article 4 covered with short setules, article 5 0.2 length of 4, rounded, with tuft of long, simple setae; epipod about as long as palp, width about third length, tapering to acute point.

Pereopods similar, with 2 claws; basis about 4

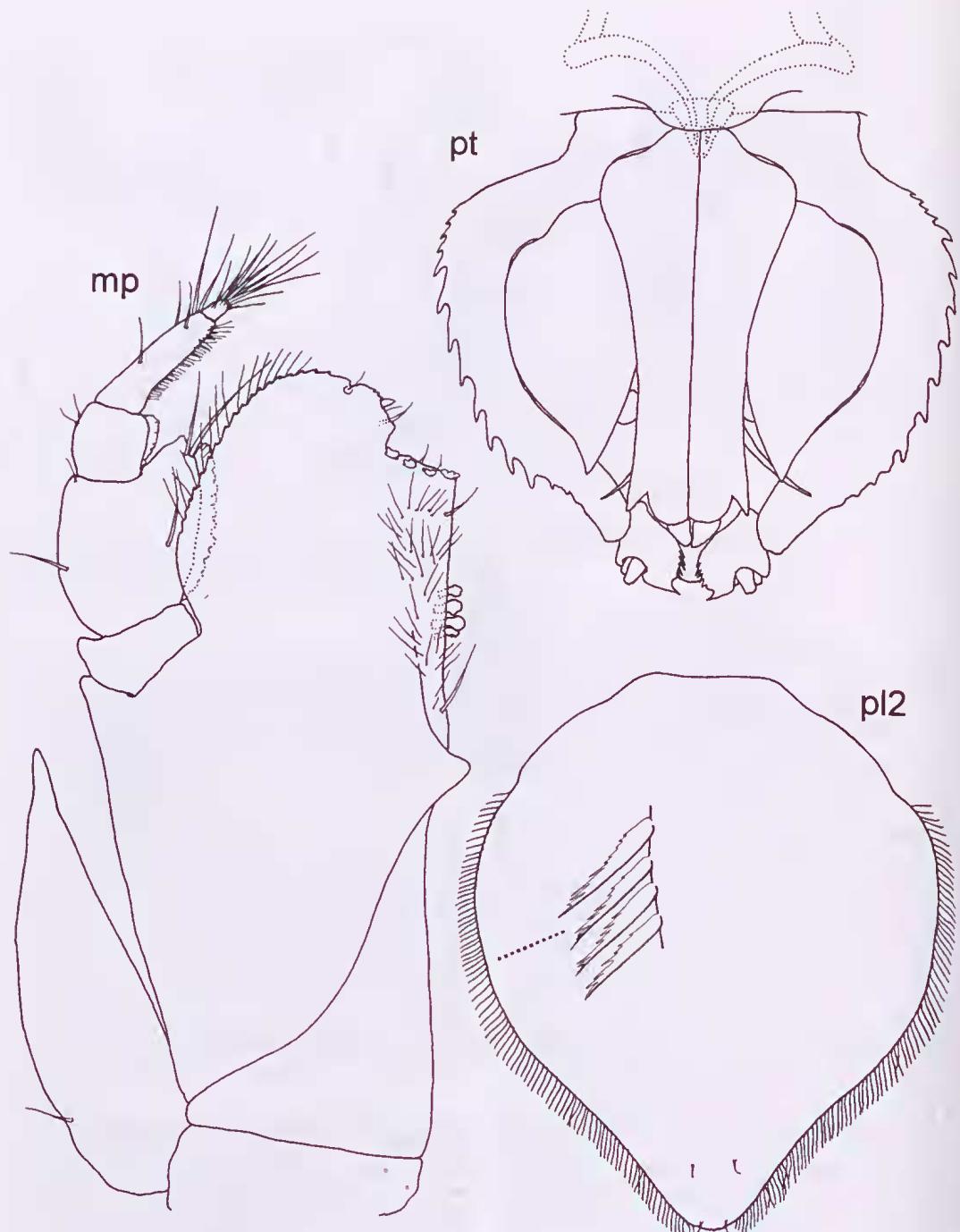


Figure 11. *Rugojoeropsis rugosa* gen. nov., sp. nov. pt, pleotelson, ventral view (paratype, male, NMV J18679); mp, maxilliped (paratype, female, NMV J18677); pl2, pleopod 2 (holotype).

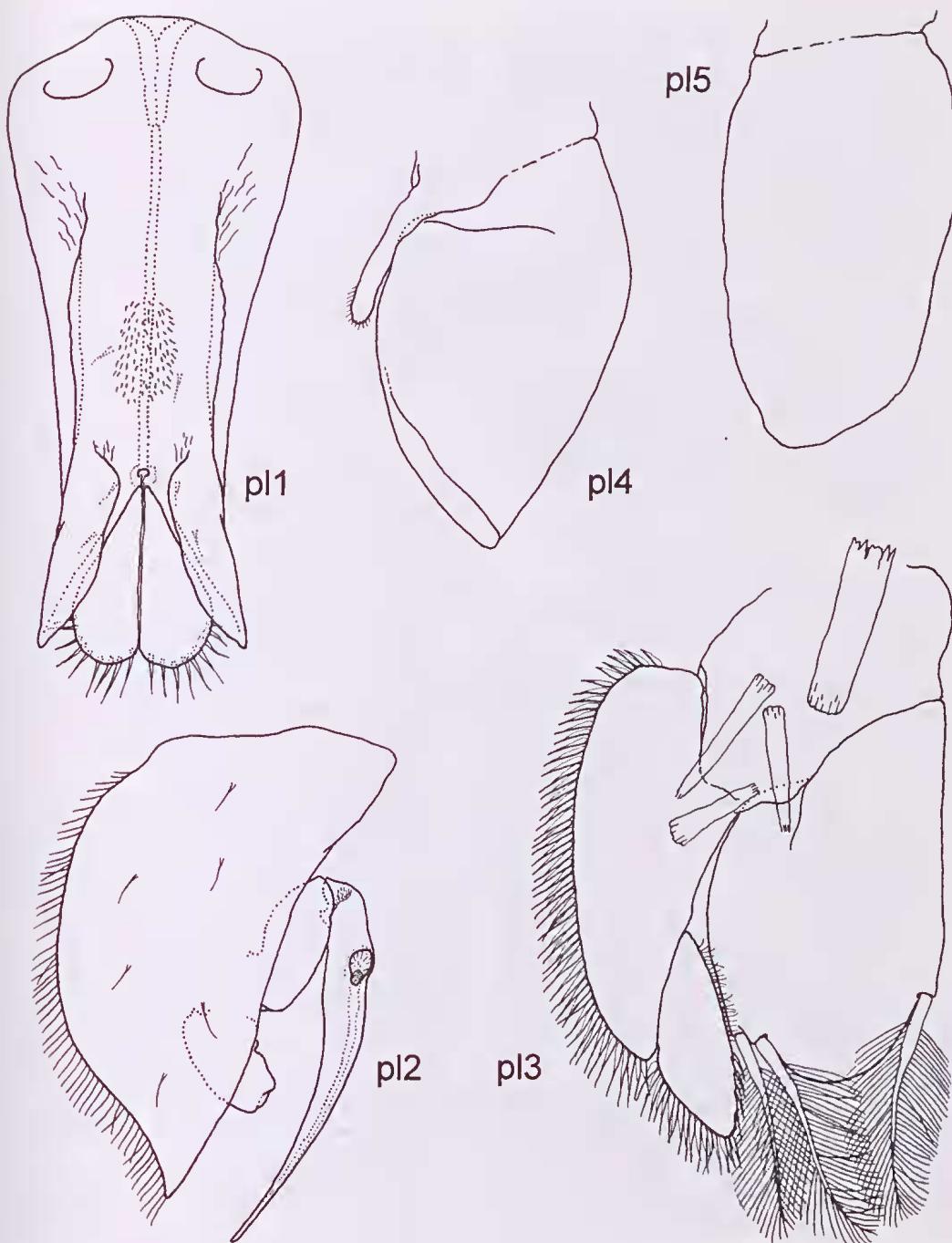


Figure 12. *Rugojoeropsis rugosa*, gen. nov., sp. nov. Paratype, male, (NMV J18679): pl1, pleopod 1, dorsal view; pl2, pleopod 2, ventral view. Holotype, pl3-5, pleopods 3-5, (apex of pl4 artificially folded).

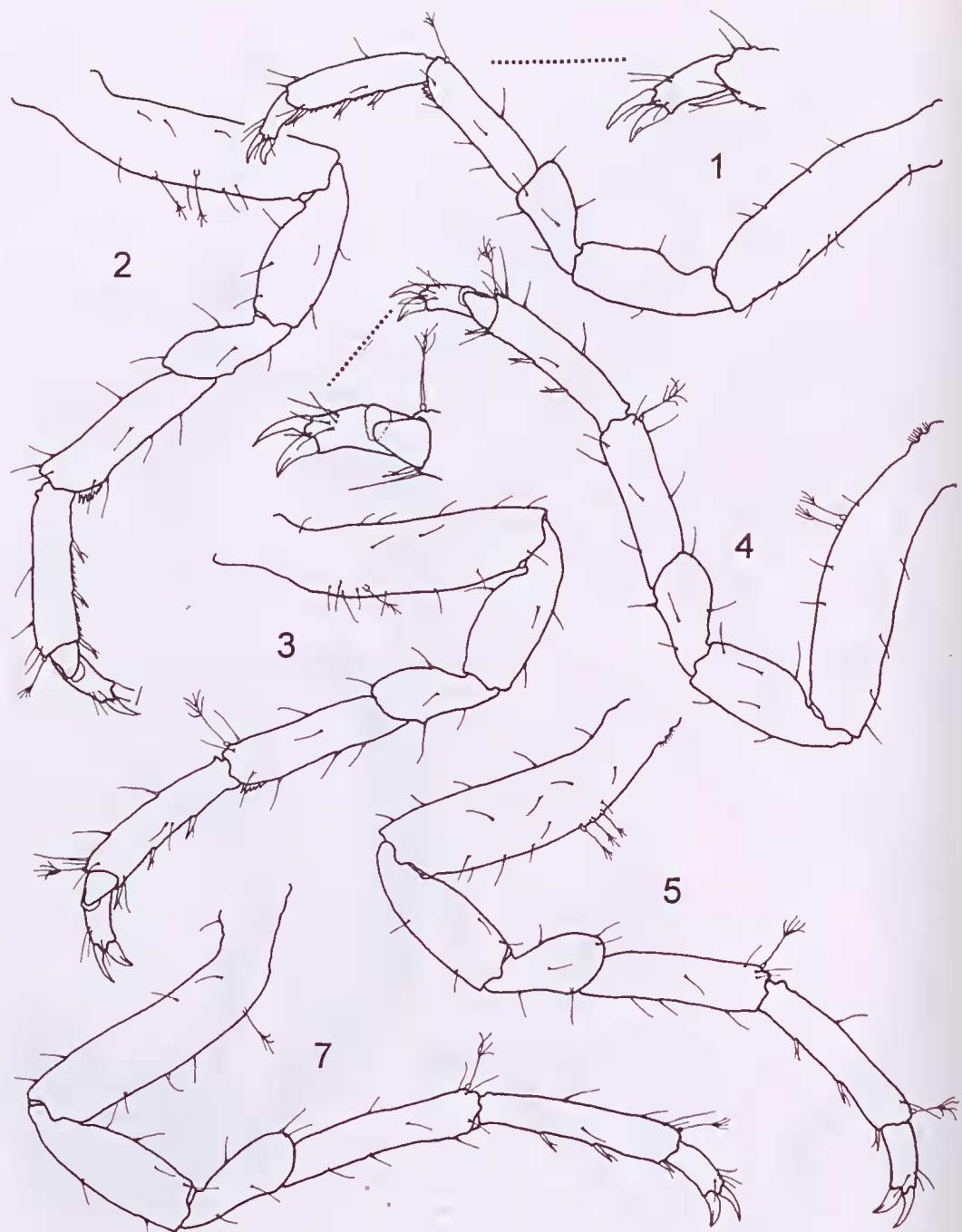


Figure 13. *Rugojoeropsis rugosa* gen. nov., sp. nov., holotype. Pereopods 1-5 and 7.

times longer than wide, twice length of ischium, with 1 or more penicillate setae on proximal half of dorsal margin (not verified in pereopod 1); merus about 0.6 length of ischium, dorsodistally expanded; carpus slightly wider than and of subequal length to propodus, single bottlebrush seta on dorsoapical margin, ventrodistal corner of carpus of some pereopods with group of acute, forward pointing spines, (verified on pereopods 1, 2 and 3 only in several specimens); propodus with 3 slender, robust seta along ventral margin, single penicillate seta dorsoapically; daetylus of pereopod 1 about third length of propodus, of pereopods 2-7 about 0.4 length of propodus, all about twice as long as wide, dorsal and ventral claws of subequal length, dorsal claw more slender.

Pleopods: Male pleopod 1 2.3 times longer than greatest width, tapering towards distal two-thirds, margins only slightly diverging in distal third, apical lobes broadly rounded, set off from lateral margins by acute backward pointing projection reaching about two-thirds along apical lobes, apical lobes fringed with simple setae; dorsal surface with simple stylet guides running from sperm duct opening to acute lateral corners, covered by extended lateral edge of stylet guide; middorsal surface with oval field of tiny setules. Male pleopod 2, protopod length 2.25 times midwidth, proximal 0.8 of lateral margin evenly convex, distal fifth concave, apex pointed, entire lateral margin with dense fringe of elongate cuticular scales serrate along anterior edge (cf. female, Fig. 11, pl2); stylet evenly curved, in retracted position reaching to apex of protopod. Female pleopod 2, shaped like combined protopods of male pleopod 2 except distolateral concavity about third length of lateral margin, lateral fringe of cuticular scales as in male, apex rounded with a few tiny simple setae. Pleopod 3, endopod rounded rectangular, width about 0.7 midsurface length; exopod article 1 about 0.9 length of endopod, barely reaching apex of endopod, lateral margin densely fringed with long, narrow cuticular scales; exopod article 2 articulating along medial margin of article 1, about half length article 1, reaching beyond endopod by third length, distally tapering to rounded apex, lateral margin fringed with long slender cuticular scales, medial margin fringed with short setules proximally and short simple setae distally. Pleopod 4, endopod of subequal size and shape to endopod pleopod 3; exopod a vestigial rounded lobe with apical setules, about six times longer than wide. Pleopod 5 similar to pleopod 4 endopod in size and shape.

Uropods: Peduncle broadly expanded medially, mediolateral corner reaching beyond apex of pleotelson, ventrodistally with a few simple submarginal setae, distal half of medial margin strongly serrate, mediolateral corner produced mediad, acutely pointed; rami of unequal length, outer ramus two-third length of inner ramus, with apical tuft of long simple setae, inner ramus about two-third length of lateral margin of peduncle, width 0.4 length, with midventral row of long, simple setae and several apical penicillate setae.

Size. Largest male 2.8 mm; largest female 2.8 mm.

Distribution. Eastern Australia south of 37°S, eastern Bass Strait, east coast of Tasmania; 400-600 m.

Etymology. From the Latin *rugosus* = uneven or rough, alluding to the texture of the cuticle.

Scaphojoeropsis gen. nov.

Type species. *Scaphojoeropsis multicarinata* sp. nov.

Diagnosis. Joeropsididae with body strongly tapering in dorsal view from pereonite 2 to apex of pleotelson, with variety of dorsal humps and short keels. Cuticle roughly calcified. Cephalon with midanterior dorsal surface strongly depressed, depression surrounded by sharp ridge, anterior margin straight. Pseudorostrum pointing downward, joining vertex along straight line, without apical projection. Eyes absent. Upper lip more than twice as wide as long. Mandibles with incisor divided into 2 parts, with large terminal tooth pointing forward, posterior 2-3 teeth on broad flange pointing mediad to backwards; spine row setae short, stubby, in irregular row. Lower lip, lobes wider than long, rectangular, lateral corners projecting, pointed. Maxilliped in ventral view covering about third of cephalic width, not reaching forward to cover mandibles; endite reaching to middle of palp article 2; palp 0.8-0.9 length of endite; palp article 3 with distinctive medial lobe; article 4 shorter than 3. Pleopod 2 of female with long apical setae. Pleopod 3 exopod with transverse articulation between articles.

Included species. *Scaphojoeropsis kimblae* sp. nov., *S. multicarinata* sp. nov.

Etymology. From the Greek *skaphe* = boat, alluding to the body shape in dorsal view.

Scaphojoeropsis multicarinata sp. nov.

Figures 14–18

Material examined. Holotype. Vie. Bass Strait, S of Point Hicks, $38^{\circ}14.80'S$, $149^{\circ}9.30'E$, 200 m, coarse sand and gravel, WHOI epibenthic sled, M.F. Gomon et al., 24 Jul 1986, ORV *Franklin* (stn SLOPE-41), NMV J18691 (female, 2.2 mm, with 6 slides).

Paratypes (11 specimens). NSW. Off Nowra, $34^{\circ}59.52'S$, $151^{\circ}5.94'E$, 204 m, coarse shell, WHOI epibenthic sled, G.C.B. Poore et al., 14 Jul 1986, ORV *Franklin* (stn SLOPE-1), NMV J18690 (4, 1 female illustrated, see Fig. 1).

Vie. S of Point Hicks, $38^{\circ}14.80'S$, $149^{\circ}9.30'E$ 200 m, coarse sand and gravel, WHOI epibenthic sled, M.F. Gomon et al., 24 Jul 1986, ORV *Franklin* (stn SLOPE-41), NMV J27719 (1 male, pleotelson and pleopods 1 and 2 illustrated, 1 slide). 50 km S of Mallacoota, $38^{\circ}06.2'S$, $149^{\circ}45.5'E$, 188 m, WHOI epibenthic sled, R. Wilson, 14 Oct 1984, FRV *Soela* (stn SO5/84/30), NMV J18694 (3).

Tas. Bass Strait, 63 km E of North Point, Flinders I., $39^{\circ}44.8'S$, $148^{\circ}40.6'E$, 124 m, fine sand and mud, SM grab, R. Wilson, 14 Nov 1981, RV *Tangaroa* (stn BSS 167), NMV J18692 (2). Bass Strait, 100 km NE of North Point, Flinders I., $38^{\circ}51.58'S$ $148^{\circ}26.5'E$, 130 m, fine sand, SM grab, R. Wilson, 15 Nov 1981, RV *Tangaroa* (stn BSS 170), NMV J18693 (1).

Description. Cephalon 2.5 times wider than midline length, midanterior margin broadly concave in dorsal view, concavity rimmed by raised keel, with 2 keels reaching backwards halfway along cephalon on each side of midline, small keel present immediately lateral to posterior part of backward reaching keels, low keel present anterolaterally on each side forming recurved loop lateral to insertion of antenna 1; pseudorostrum evenly convex.

Body broadest at pereonites 2 and 3. Pereonites with middorsal longitudinal keel, that of pereonite 1 divided into short anterior and longer posterior part, pereonite 1 with small crescent shaped keels lateral to each part of midkeel, pereonites 2–7 with single middorsal keel and crescent shaped mid-lateral keels, anterior parts of midand lateral keels linked by low serrate ridge; pereonites 1–4 of equal length, pereonites 5–7 of equal length, 0.8 length of more anterior pereonites. Pleotelson width about 1.1 length, with middorsal longitudinal keel reaching to base of apical lobe; lateral margins smooth except for fringe of cuticular outgrowth, evenly tapering towards broadly rounded apex, with deep insinuation for uropods each side of apex.

Antenna 1 of 6 articles; article 1 rectangular, not reaching lateral corner of frontal sinus, width two-thirds length, about twice as long as and third as wide again as article 2 which is barely twice as

long and wide as 3, articles 2 and 3 with lateral flange of cuticular outgrowth; flagellum of 3 articles, article 1 two-thirds length of peduncle article 3, article 2 as long as peduncle article 3, article 3 as long as and half width of 1, articles 2 and 3 each with 1 long aesthetase. Antenna 2, peduncle articles 1–3 of slightly increasing length and width, article 3 distally expanded, distal width twice midlength, article 4 third length of 3, about 5 times wider than long, halfway embedded into 3, article 5 nearly twice as long as 1–4 combined, broadly expanded laterally, width, excluding broad fringe of cuticular outgrowth, two-thirds length, article 6 about 0.4 length of 5, expanded distally; flagellum as long as peduncle article 6, with up to 6 articles, article 1 not inflated, apparently not conjoint, as long as articles 2 and 3 combined.

Mouthparts: Upper lip nearly rectangular, distal margin slightly convex, fringed with setules, distolateral corners distinct, slightly projecting. Mandible palp slender, not reaching to near apex of forward pointing tooth of incisor, article 2 0.6 length of 1, article 3 six-sevenths length of 2, article 2 with 2 mediolateral pectinate setae, article 3 with 2 terminal pectinate seta; incisor with 1 large forward pointing tooth and 3 mediad to backward pointing teeth on broad flange, forward pointing tooth of right mandible with lateral serration along proximal two-thirds; spine row of few short, stout, minutely pectinate setae, left with row divided into 2 groups (distalmost slightly stouter non-peetinate seta possibly homologous with *laeinia mobilis*). Lower lip, about 3 times broader than long, body rectangular, distolateral parts expanded to wing-like projections with slightly acute anterior and posterior corners, lateral margins convex. Maxilla 1 outer plate with 10 unequally long finely dentate setae and 3 short simple setae on middorsal margin; inner plate with evenly rounded apex half width of outer plate, reaching to middle of medial margin of outer plate, with 2 apical simple setae and several short apical setules. Maxilla 2, inner and middle plates of equal length and width, 0.75 length and 0.6 width of outer plate with 2 subequal, straight, finely pectinate setae terminally, outer plate with 3 finely pectinate setae, apical one as long as plate, both subapicals much shorter and more slender. Maxillipeds covering about third ventral width of cephalon, endites reaching forward to cover bodies of maxillae but not mandibular incisors or upper lip; basis twice as long as midwidth, endite reaching to about middle of palp article 2, mediolateral concavity vestigial with single multideterminate lump-shaped seta;

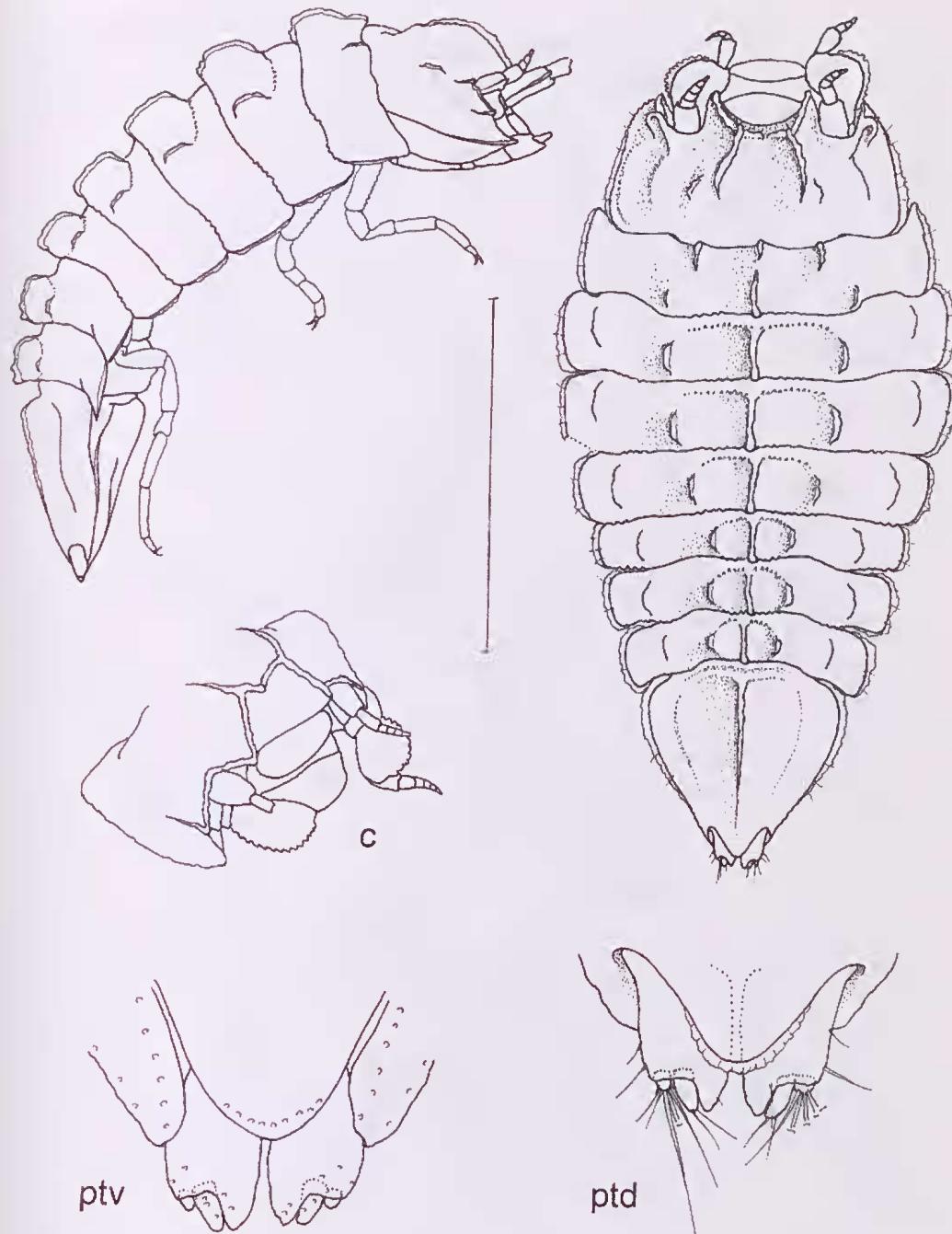


Figure 14. *Scaphojoeropsis multicarinata* gen. nov., sp. nov., holotype. c, cephalon, anterolateral view; ptd, apex of pleotelson, dorsal view; ptv, apex of pleotelson, ventral view, setae omitted. Habitus scale bar: 1 mm.

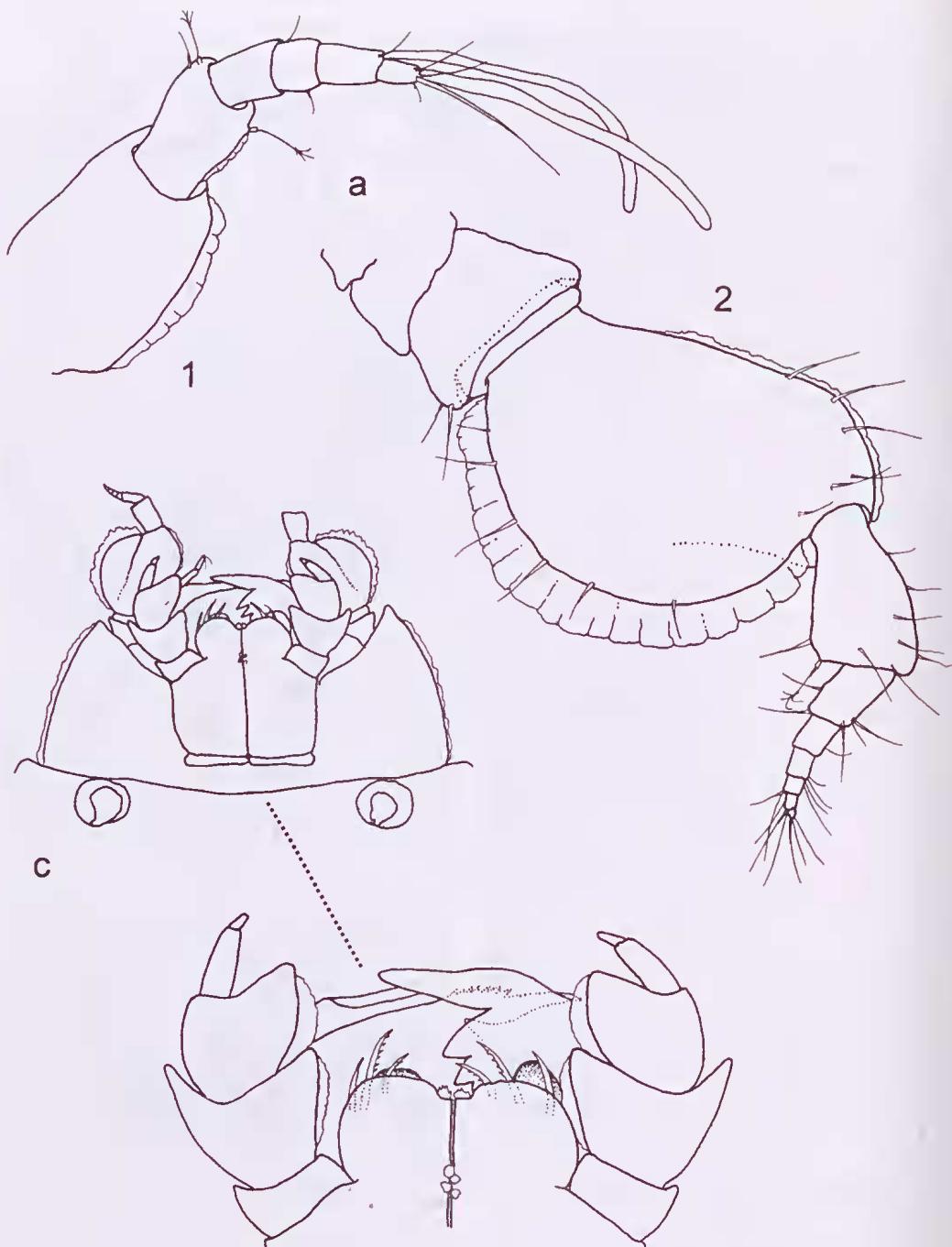


Figure 15. *Scaphojoeropsis multicarinata* gen. nov., sp. nov., holotype. a, antennae (1 and 2); c, cephalon, ventral view.

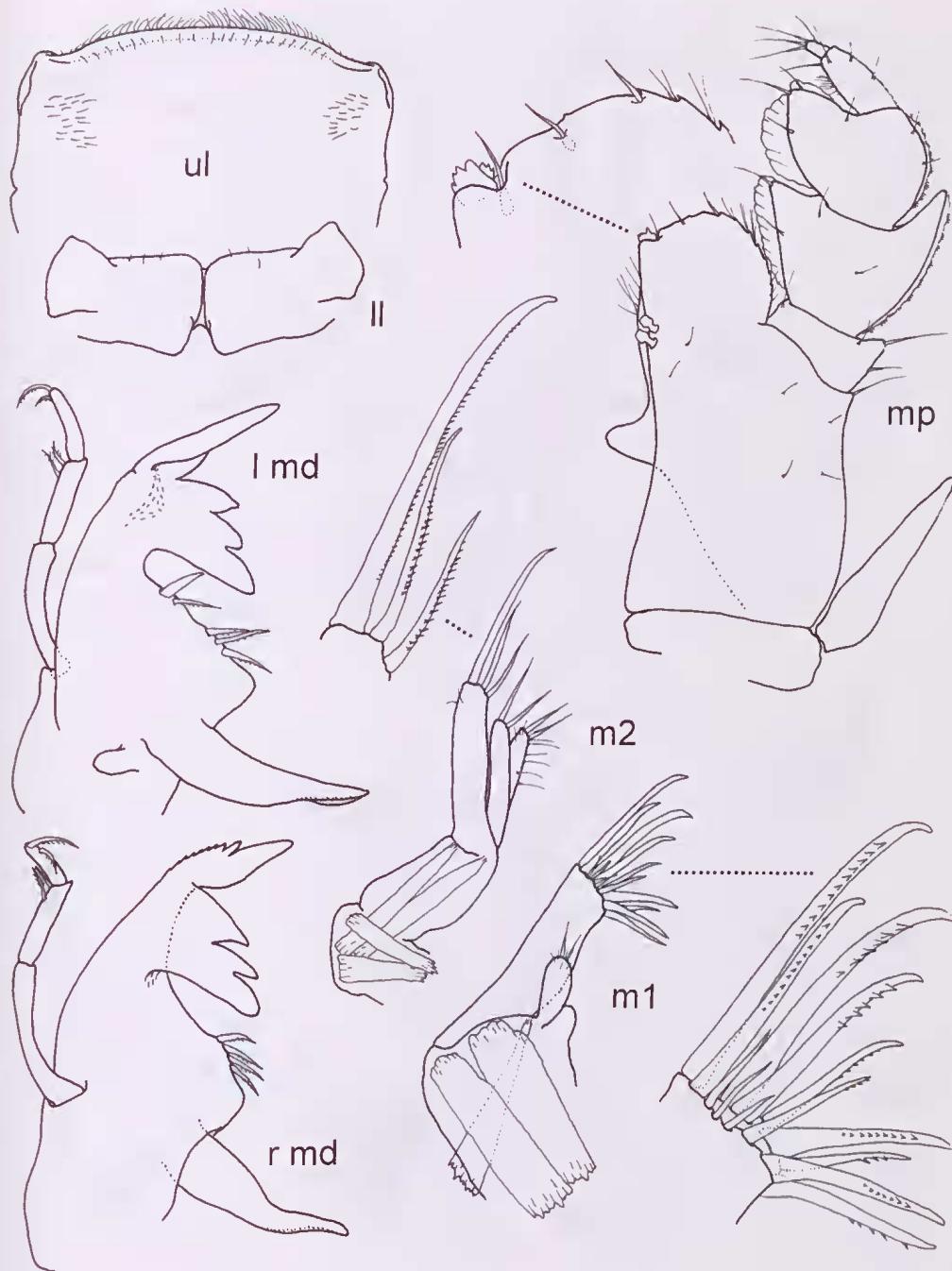


Figure 16. *Scaphojoeropsis multicarinata* gen. nov., sp. nov., holotype. II, lower lip; **md**, mandible (l, left, r, right); **m**, maxilla (1 and 2), **mp**, maxilliped; **ul**, upper lip.

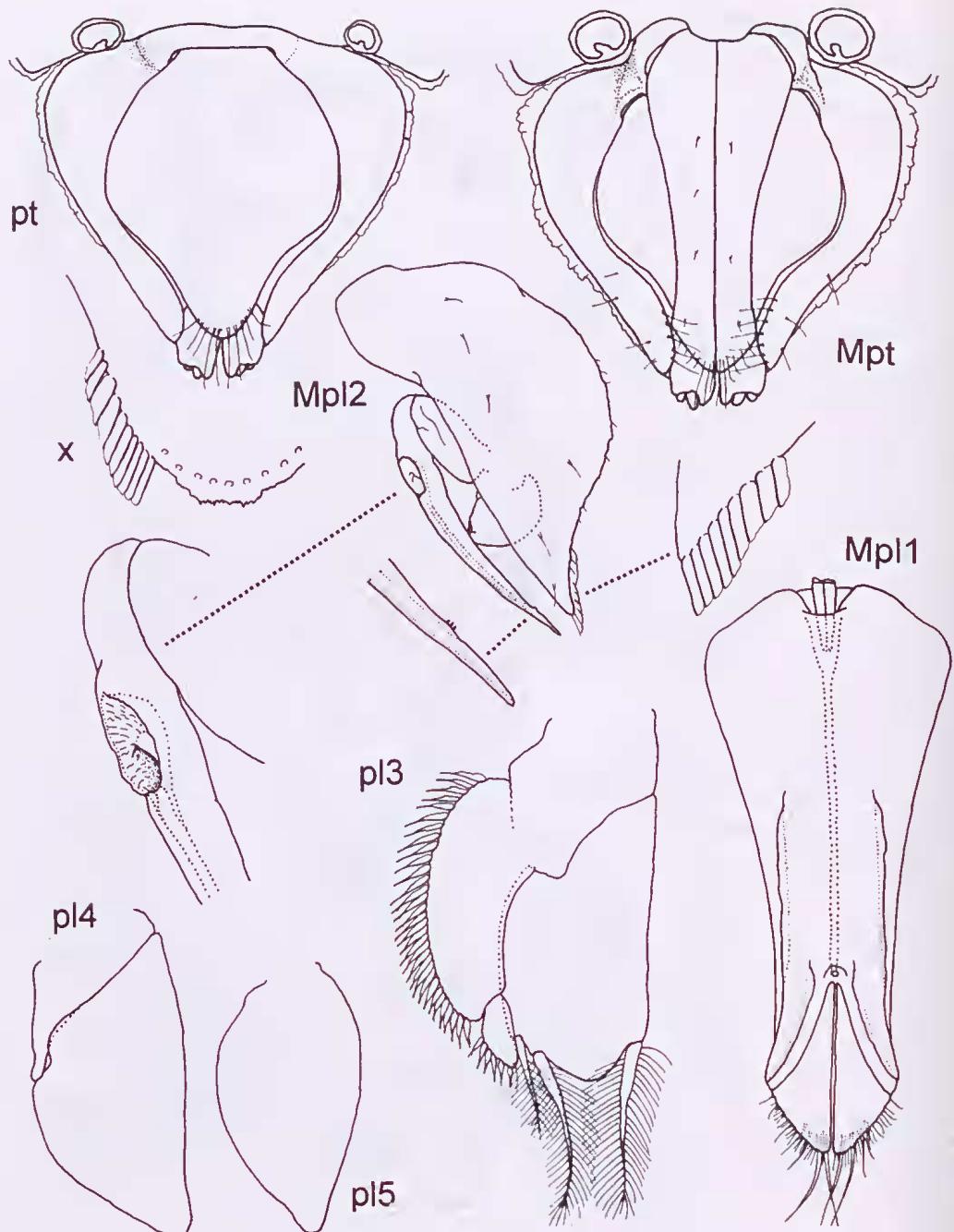


Figure 17. *Scaphojoeropsis multicarinata* gen. nov., sp. nov., holotype, except **M**: paratype, male, (NMV J27719). **pl**, pleopod (1–5); **pt**, pleotelson ventral view; **x**, apex of female pleopod 2.

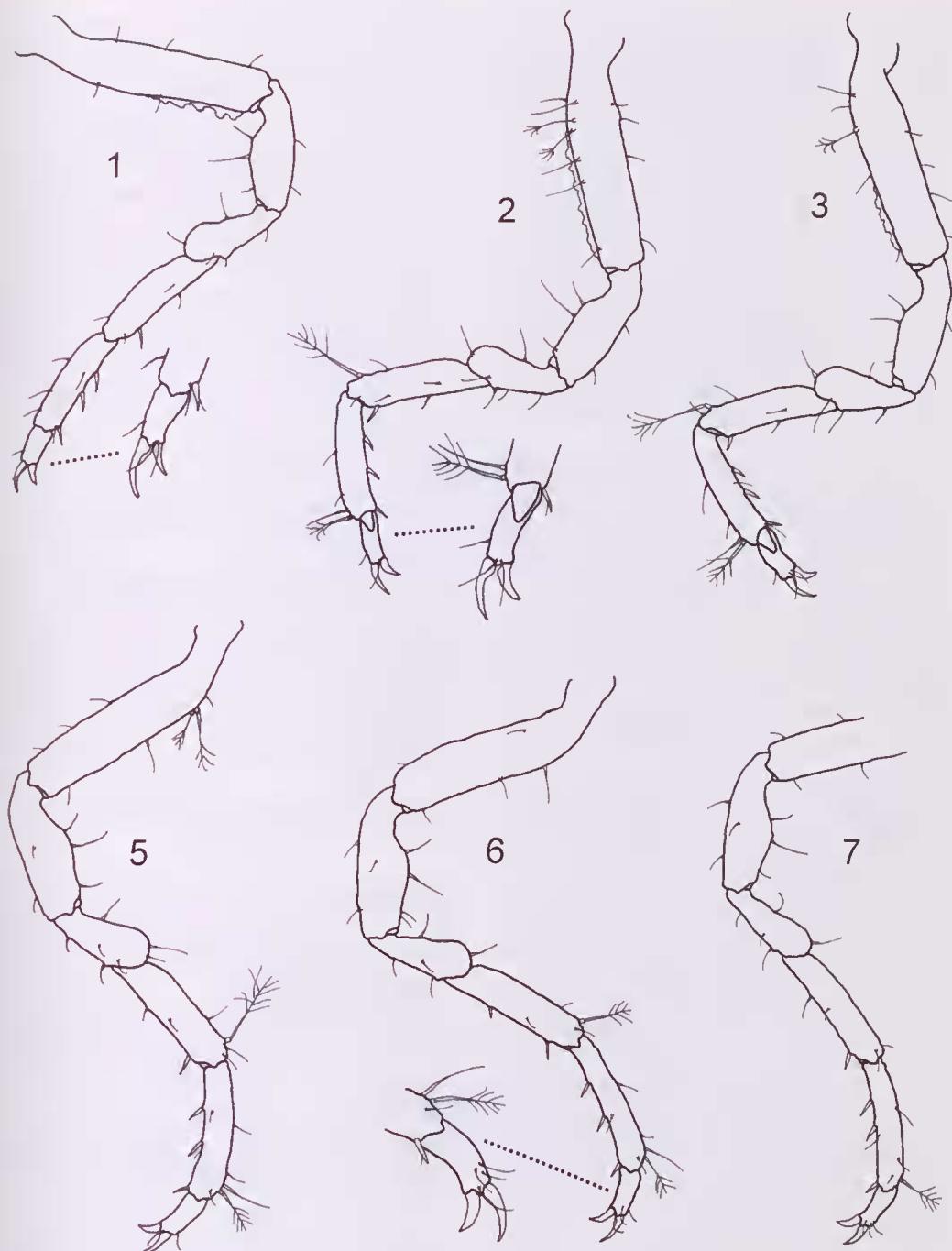


Figure 18. *Scaphojoeropsis multicarinata* gen. nov., sp. nov., holotype. Pereopods 1-3, 5-7.

distolateral margin of endite evenly rounded, finely serrate, with single slender setule in each indentation, apical margin somewhat truncate with a few short simple setae; palp articles 2 and 3 as broad as or broader than endite, palp article 2 2.5 times longer than 1 along midsurface, with acute, mediad pointing medial lobe and acute forward pointing distolateral lobe reaching halfway along article 3; article 3 subequal to 2 in length and width, medially expanded to large, forward pointing, rounded lobe, medial margins of articles 2 and 3 with coarse fringe of cuticular outgrowth, lateral margin with tiny etules; article 4 two-thirds length of 3, medial surface with setules in middle third; article 5 about third length of 4, rounded, with tuft of long, simple setae; epipod as long as palp articles 1, 2 and half of 3 combined, tapering to blunt point.

Pereopods similar, with 2 claws; basis about 5 times longer than wide, twice length of ischium, with 1 or more penicillate setae on proximal half of dorsal margin; merus about two-thirds length of ischium, with broadly rounded expansion dorsodistally; carpus and propodus length subequal to ischium, with 1 or 2 penicillate setae on dorsal margin (not verified on pereopod 1); propodus with 3 slender, robust setae along ventral margin; dactylus of all pereopods about two-thirds length of propodus, about twice as long as wide; dorsal claw slightly longer than ventral claw.

Pleopods: Male pleopod 1 2.3 times longer than greatest width, tapering towards distolateral corners, apical lobes evenly rounded joining lateral margins at wide angle, apical lobes fringed with short setules and medium to long simple setae; dorsal surface with simple, uncovered stylet guides running from sperm duct opening to lateral corners. Male pleopod 2 protopod 2.5 times longer than midwidth, proximal two-thirds of lateral margin evenly convex, distal third concave, apex pointed, distalmost part of lateral margin with overlapping rectangular cuticular scales; stylet evenly curved, in retracted position reaching to apex of protopod, with group of tiny teeth laterally one sixth length from apex. Female pleopod 2 shaped like combined protopods of male pleopod 2 except apex broadly rounded with fringe of long, simple setae; marginal cuticular scales as in male. Pleopod 3 endopod rectangular, width 0.6 length of medial margin; exopod barely reaching apex of endopod, article 1 as long as endopod, article 2 articulating with 1 at nearly right angle, twice as long as wide, about third length of article 1, distally tapering to blunt apex; lateral margin of both articles fringed with robust

elongate cuticular scales. Pleopod 4 endopod subequal in length to endopod pleopod 3, tapering to rounded apex; exopod a tiny rounded lobe without setules. Pleopod 5 similar to pleopod 4 endopod in shape.

Uropods extending beyond apex of pleotelson by third their length; peduncle with broad, rounded medioapical, backward pointing projection covering length of inner ramus, medial length of peduncle including medial projection 1.5 midwidth; rami of unequal length, outer ramus third to half length of inner ramus, with tuft of long, simple apical seta; inner ramus width 0.5 length, with single, simple seta apically and a few setae on ventral surface.

Size. Largest male 1.6 mm; largest female 2.6 mm.

Distribution. Eastern Australia south of 35°S, to eastern Bass Strait; 124–204 m.

Etymology. The specific epithet refers to the many short dorsal keels.

Remarks. *Scaphojoeropsis multicarinata* is most easily distinguished from *S. kimbiae* sp. nov. (condition in parentheses) by its dorsal carinae on pereon and pleotelson (no carinae), uropod peduncle with mediadistal projection (no projection), maxilla 2 with full complement of three lobes (reduced to one lobe), and male pleopod 1 with rounded apex (apex with two acute lobes).

Scaphojoeropsis kimbiae sp. nov.

Figures 19–22

Material examined. Holotype. Tas. 60 km E of North Point, Flinders I., 39°41.7'S, 148°39.5'E, 115 m, muddy sand, naturalists' dredge, G.C.B. Poore, 27 Mar 1979, HMAS *Kimbla* (stn BSS 32), NMV J18695 (male, 2.1 mm, with 7 slides).

Paratypes (4 specimens). NSW. Off Eden, 37°0.60'S 150°20.70'E, 363 m, coarse shell, WHOI epibenthic sled, G.C.B. Poore et al., 21 Jul 1986, ORV *Franklin* (stn SLOPE-22). NMV J18696 (3, one without cephalon).

Tas. 60 km E of North Point, Flinders I., 39°41.7'S, 148°39.5'E, 115 m, muddy sand, naturalists' dredge, G.C.B. Poore, 27 Mar 1979, HMAS *Kimbla* (stn BSS 32), NMV J27720 (1 female, with 1 slide).

Description. Cephalon about 4 times wider than dorsal midlength, midanterior margin nearly straight in dorsal view, depressed anterior part rimmed by raised concave keel, with 2 straight keels reaching backwards from lateral parts of concave rim halfway along cephalon, small hump present on both sides posterior to insertion of

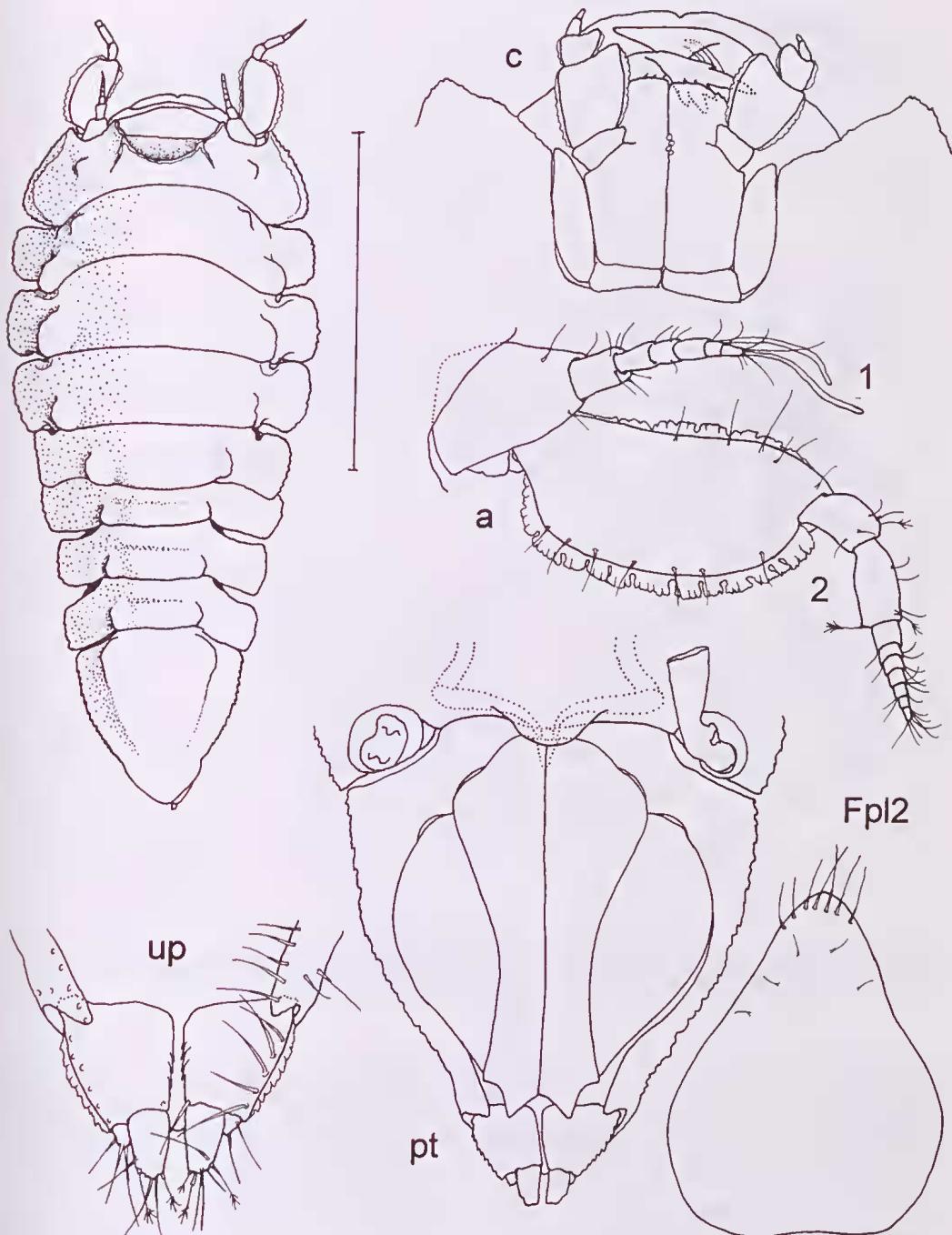


Figure 19. *Scaphojoeropsis kimblae* gen. nov., sp. nov., holotype, except F: paratype, female, (NMV J27720). a, antennae (1 and 2), right, dorsal view; c, cephalon, ventral view; pl2, female pleopod 2; up, uropods, ventral view; pt, pleotelson, ventral view, setae omitted. Habitus scale bar: 1 mm.

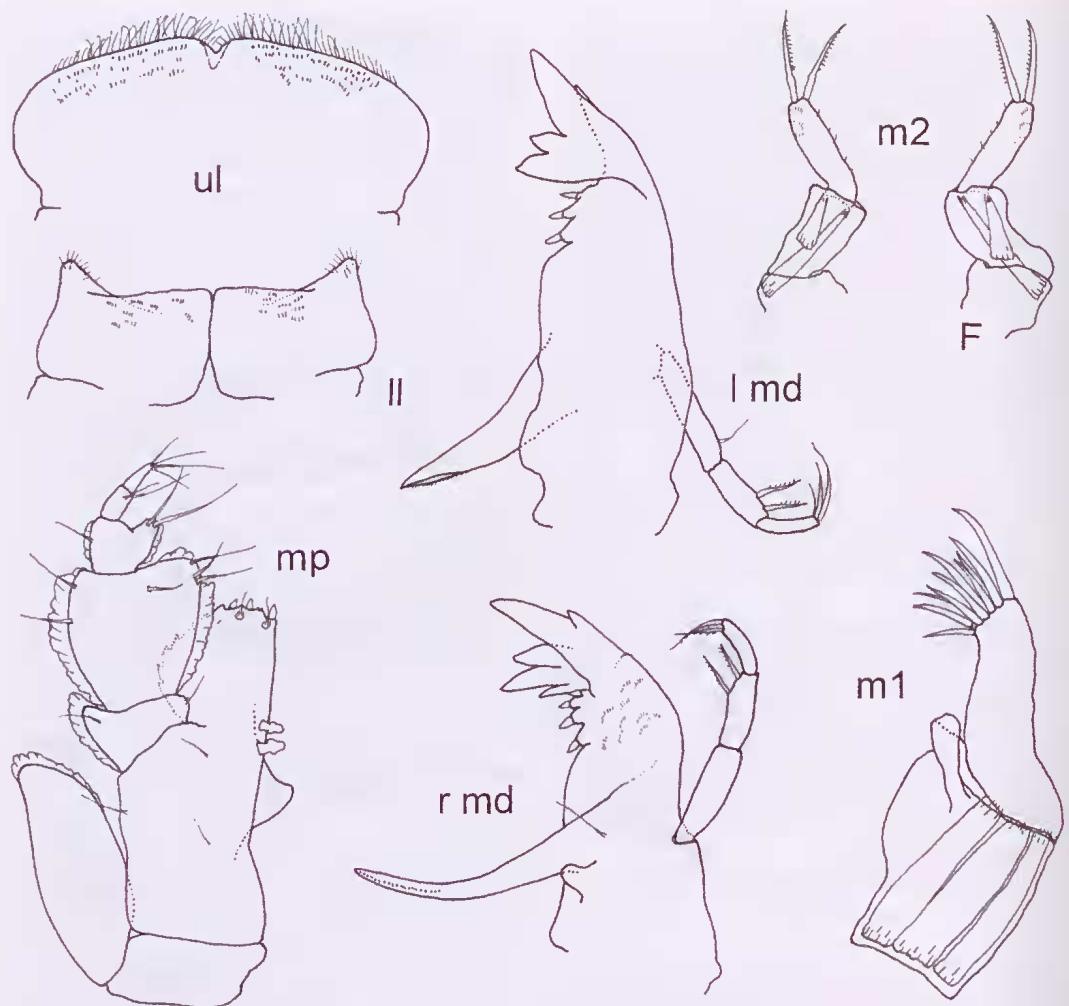


Figure 20. *Scaphojoeropsis kimbale* gen. nov., sp. nov., holotype, except F: paratype, female, (NMV J27720). II, lower lip; md, mandible (l, left, r, right); m, maxilla (1 and 2); mp, maxilliped; ul, upper lip.

antenna 1; pseudorostrum broad, convex. Body broadest at pereonite 2. Pereonites 1, 3 and 4 of subequal length, 2 about 1.2 times longer, 1 with low midanterolateral humps, 1–4 with larger posterolateral humps; pereonites 5–7 of equal length, three-quarters length of 4, posterolateral humps joined across posterior half of pereonite to form low, rounded ridge. Pleotelson length about 1.1 width, lateral margins finely, irregularly serrate, convexly tapering to narrow point at three-quarters length and further to broadly rounded apex; apex without incisions for uropods in dorsal view, uropods barely visible in dorsal view.

Antenna 1 of 7 articles; article 1 distally tapering, reaching lateral corner of frontal ridge, width at base 0.8 length, about 2.5 times longer than article 2, articles 2 and 3 of subequal length, 3 about two-thirds width of 2; flagellum of 4 articles, article 2 length 1.25 times 1, articles 2 and 4 with 1 long aesthetase (broken off in 3?). Antenna 2, (configuration of peduncle articles 1–4 not clarified, possibly as in *S. multicarinata*, at least article 4 very short), article 5 moderately expanded laterally, width, excluding broad euticular fringe, 2.3 times length, article 6 length 1.5 width, about 0.25 length of 5; flagellum barely 3

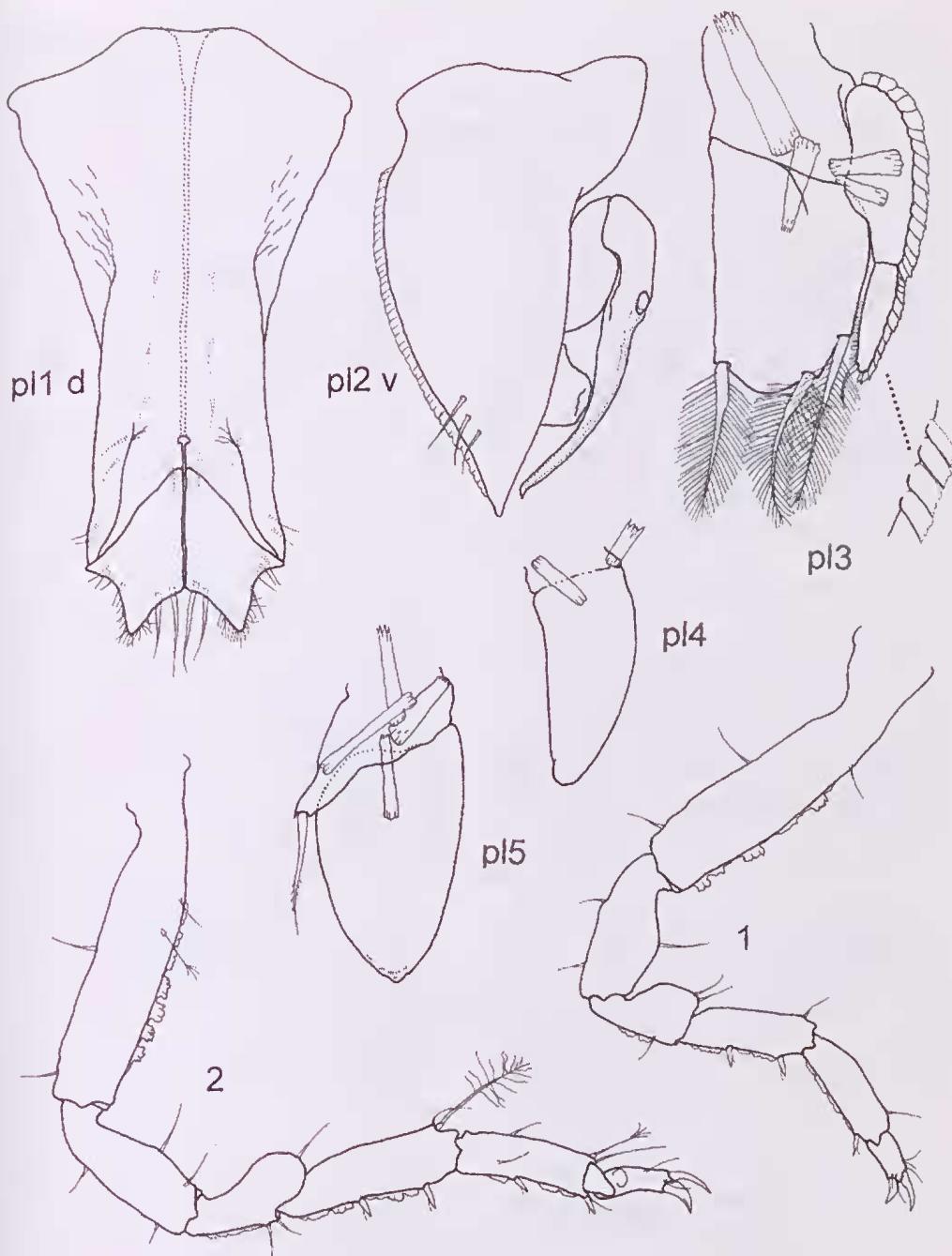


Figure 21. *Scaphojoeropsis kimblae* gen. nov., sp. nov., holotype. **pl**, pleopod (1–5); **p**, pereopod (1 and 2); **d**, dorsal view; **v**, ventral view.

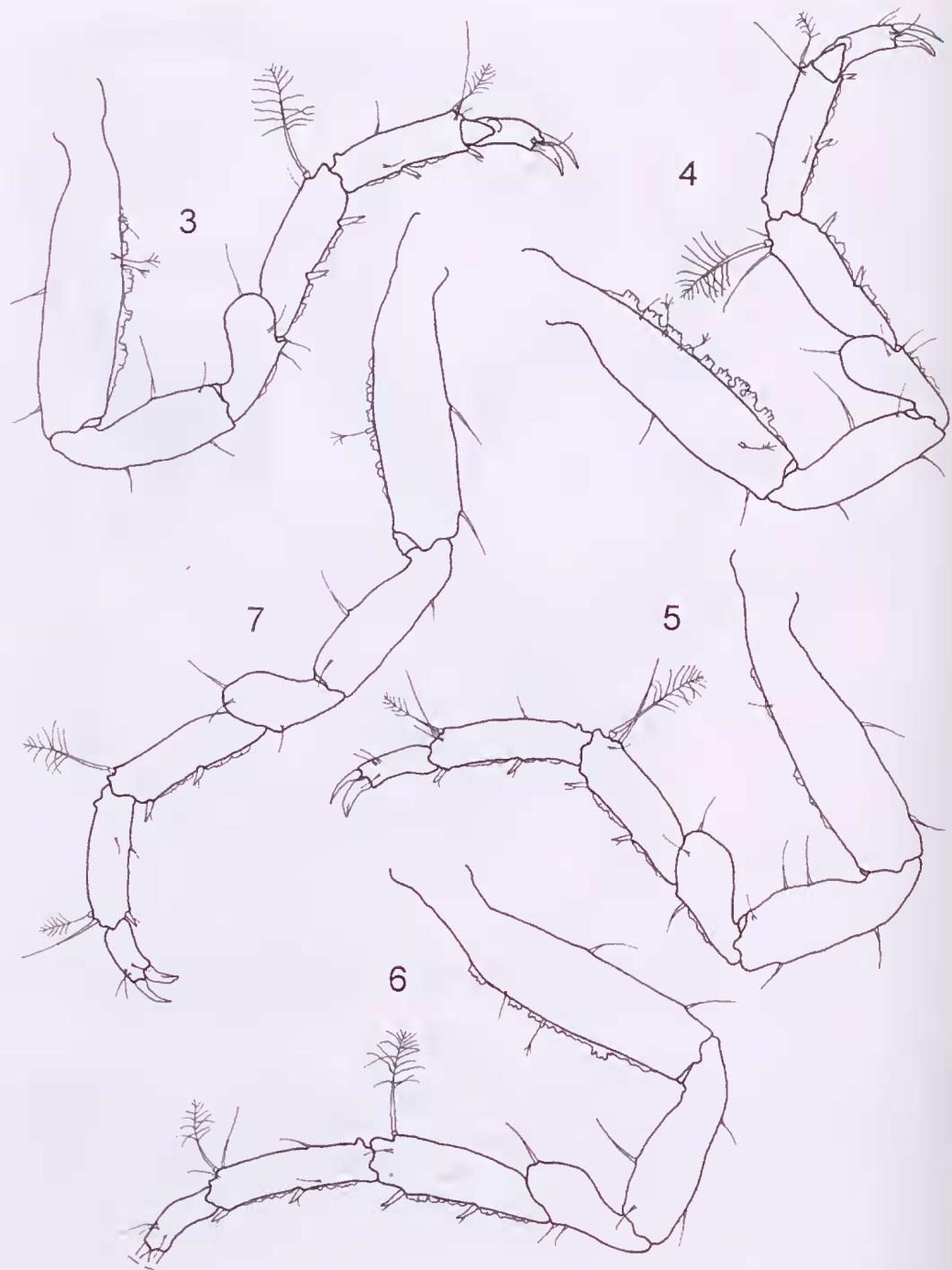


Figure 22. *Scaphojoeropsis kimblae* gen. nov., sp. nov., holotype. Pereopods 3–7.

times longer than peduncle article 6, with up to 8 articles, article 1 not inflated, apparently not conjoint, as long as articles 2–7 combined.

Mouthparts: Upper lip, length about 0.4 width, anterior margin convex, notched in middle, fringed with long setules, lateral margins rounded. Mandible palp slender, reaching to middle of incisor, article 2 about two-thirds length of 1, article 3 0.8 length of 2, article 2 with 2 mediadistal pectinate setae, article 3 with 3 terminal pectinate seta; incisor with 1 forward pointing tooth and 3 mediad pointing teeth on broad flange, forward pointing tooth of right mandible with small accessory tooth laterally; spine row composed of 4 short, peg-like setae on conical projections. Lower lip about 3 times broader than long, body rectangular, distolateral corners projecting forward to rounded apices. Maxilla 1 outer plate with 10 unequally long completely smooth setae; inner plate a vestigial rounded lobe without setae. Maxilla 2 composed of single plate, about 3 times longer than wide, with 2 pectinate robust setae apically. Maxillipedes covering about third of ventral width of cephalon, endites reaching forward to cover bodies of maxillae but not mandibular incisors and upper lip; basis length 2.5 times midwidth, reaching about two-thirds along palp article 2, mediadistal concavity vestigial with single peg like robust seta; lateral margin of endite evenly rounded, coarsely serrate, apical margin somewhat truncate with 2 peg-like robust setae and a few short simple setae; palp article 2 broader than endite; palp article 1 with short distolateral projection; article 2 broadly expanded medially, about 3 times longer than 1 along midsurface; article 3 about half length and width of 2, with medial rounded lobe; medial margins of articles 2 and 3 and lateral margin of 1, 2 and 3 with coarse fringe of cuticular outgrowth; articles 4 and 5 of subequal length and width, combined as long as 3; epipod reaching to insertion of palp, 2.3 times longer than wide, rounded apex with fringe of cuticular outgrowth.

Pereopods similar, with 2 claws; basis about 4.5 times longer than wide, twice length of ischium; 2–7 with 1 or 2 small penicillate setae midway on dorsal margin; merus about two-thirds length of ischium, with broadly rounded expansion dorsodistally; carpus and propodus of subequal length, about 0.8 length of ischium, with single large penicillate seta on dorsoapical margin; carpus and propodus with 1 or 2 slender, robust setae along ventral margin; fringe of cuticular outgrowth along dorsal margin of basis and ventral margin of merus, carpus and propodus;

dactylus of all pereopods about half length of propodus, about 2.5 times longer than wide; dorsal claw subequal in length to and more slender than ventral claw.

Pleopods: Male pleopod 1 midlength about 1.7 times greatest width, tapering towards midpoint, slightly expanding in distal half towards right angled lateral corners; apical lobes acutely pointed, separated in midline at about 90 degrees, lateral margins concave, laterally with small simple setae, medially with long simple setae, apices with fringe of small setules; dorsal surface with funnel shaped, uncovered stylet guides running from sperm duct opening to lateral corners. Male pleopod 2, protopod 2.5 times longer than midwidth, apex acutely pointed, entire lateral margin with fringe of cuticular scales (details not available); stylet evenly curved, in retracted position reaching to about apex of protopod. Female pleopod 2, shaped like combined protopods of male pleopod 2 except apex broadly rounded with fringe of long, simple setae, (lateral cuticular scales not observed). Pleopod 3, endopod rectangular, width about two-thirds length of medial margin; exopod barely reaching apex of endopod; article 1 three-quarters length of endopod; article 2 articulating with 1 at right angle, 3 times as long as wide, about 0.6 length of article 1, distally tapering, apex rounded; lateral margin of both articles fringed with short, overlapping rectangular cuticular scales. Pleopod 4, endopod subequal in length to endopod pleopod 3, ovoid, without setae but with a few apical cuticular combs; exopod about quarter length of endopod, with single long pectinate seta apically. Pleopod 5 similar to pleopod 4 endopod but more slender.

Uropods: Peduncle without medial projection, medial margin as long as peduncle width at base, with acute denticles in midthird; rami of unequal length, outer ramus third length and width of inner ramus, with a few long simple setae; inner ramus two-thirds length of peduncle inner margin, width 0.6 length, with simple setae and penicillate setae apically.

Size. Largest male 2.1 mm; largest female 2.1 mm.

Distribution. Eastern Australia south of 37°S to eastern Bass Strait; 115–363 m.

Etymology. The species is named after HMAS *Kimbla*.

Remarks. See previous species for characters to separate *Scaphojoeropsis kimblae* from *S. multicarinata*.

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